MODELS BTR(C)120 THRU 500A

COMMERCIAL GAS, GLASS-LINED, TANK-TYPE WATER HEATER

• INSTALLATION • OPERATION • MAINTENANCE • LIMITED WARRANTY

Thank you for buying this energy efficient water heater from A.O. Smith Water Products Company. We appreciate your confidence in our product.

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

— **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

— **WHAT TO DO IF YOU SMELL GAS**

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

— **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

⚠ CAUTION

TEXT PRINTED OR OUTLINED IN RED CONTAINS INFORMATION RELATIVE TO YOUR SAFETY. PLEASE READ THOROUGHLY BEFORE INSTALLING AND USING THIS APPLIANCE.

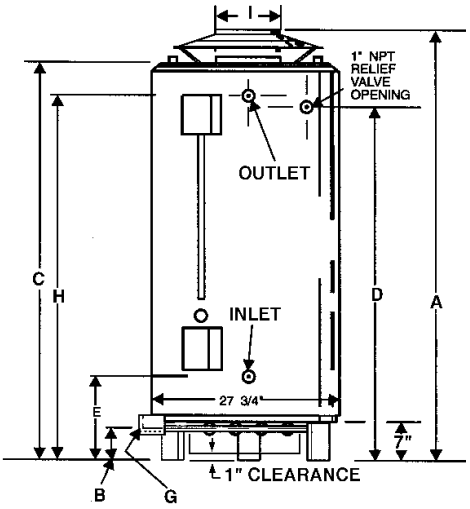
A.O. SMITH
WATER PRODUCTS COMPANY
A DIVISION OF A. O. SMITH CORPORATION
McBEE, SOUTH CAROLINA, USA
STRATFORD, ONTARIO, CANADA
www.hotwater.com

PLACE THESE INSTRUCTIONS ADJACENT TO HEATER
AND NOTIFY OWNER TO KEEP FOR FUTURE REFERENCE.

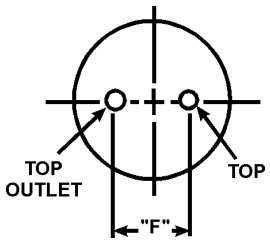
Printed in U.S.A. 2576 200

PART NO. 194027-000
SUPERSEDES PART NO. 193927-000

ROUGH-IN-DIMENSIONS



MODELS BTR(C) 120 THROUGH 500



See Models Below

FIGURE 1

BTR MODELS 120 THROUGH 500A - TABLE 1A

MODEL	INPUT RATE BTU/Hr.	APPROX. TANK CAP.	A	B	C	D	E	F	GAS INLET G	H	VENT DIA I	J	CONNECTIONS INLET TOP	INLET FRONT	INLET BACK	OUTLET TOP	OUTLET FRONT	OUTLET BACK	Approximate ship. Weight STD.	ASME
BTR120	120,000 BTU/Hr.	71 Gal	69.75"	4.25"	59.50"	50.87"	19.69"	19"	1/2"	51.88"	5"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	400 Lbs	NA
	35 Kw/Hr	268 L	177 cm	11 cm	151 cm	129 cm	50 cm	48 cm	1/2"	132 cm	13 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	182 Kg	NA
BTR154	154,000 BTU/Hr	81 Gal	73.00"	4.25"	66.50"	57.87"	19.69"	19"	1/2"	59.00"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 Lbs	NA
	45 Kw/Hr	307 L	185 cm	11 cm	169 cm	147 cm	50 cm	48 cm	1/2"	150 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTR180	180,000 BTU/Hr	81Gal	67.50"	4.50"	62.00"	53.62"	20.50"	21"	1/2"	54.62"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 Lbs	NA
	53 Kw/Hr	307 L	171 cm	12 cm	157 cm	136 cm	52 cm	53 cm	1/2"	139 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTR197	199,000 BTR/Hr	100 Gal	75.00"	4.50"	70.00"	61.62"	20.50"	21"	1/2"	62.62"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	603 Lbs	NA
	58 kW/Hr	379 L	192 cm	12 cm	178 cm	157 cm	52 cm	53 cm	1/2"	159 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	273 Kg	NA
BTR198	199,000 BTU/Hr.	100 Gal	75.00"	4.50"	70.00"	61.62"	20.50"	21"	1/2"	61.50"	6"	27.75"	1.50"	1.50"	2.00"	1.50"	1.50"	2.00"	603 Lbs	NA
	58 Kw/Hr	379 L	192 cm	12 cm	178 cm	157 cm	52 cm	53 cm	1/2"	150 cm	15 cm	71 cm	1.50"	1.50"	2.00"	1.50"	1.50"	2.00"	273 Kg	NA
BTR199	190,000 BTR/Hr	81 Gal	67.50"	4.50"	62.00"	53.62"	20.50"	21"	1/2"	54.62"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 Lbs	NA
	56 kW/Hr	307 L	171 cm	12 cm	157 cm	136 cm	52 cm	53 cm	1/2"	139 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTR 200	199,000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	6"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 Lbs	725 Lbs
	58 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	15 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTR 250	250,000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 Lbs	725 Lbs
	72 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTR 251	251,000 BTR/Hr	65 Gal	75.00"	4.50"	65.75"	57.25"	20.00"	NA	1/2"	58.75	8"	27.75"	NA	1.50"	1.50"	NA	1.50"	1.50"	750Lbs	862 Lbs
	73 kW/Hr	246 L	191 cm	12 cm	167 cm	145 cm	51 cm	NA	1/2"	149 cm	20 cm	70 cm	NA	1.50"	1.50"	NA	1.50"	1.50"	341 Kg	391 Kg
BTR 275	275,000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 Lbs	725 Lbs
	80 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTR 305	305,000 BTR/Hr	65 Gal	75.00"	4.50"	65.75"	57.25"	20.00"	NA	1/2"	58.75	8"	27.75"	NA	1.50"	1.50"	NA	1.50"	1.50"	750 Lbs	862 Lbs
	89 kW/Hr	246 L	191 cm	12 cm	167 cm	145 cm	51 cm	NA	1/2"	149 cm	20 cm	70 cm	NA	1.50"	1.50"	NA	1.50"	1.50"	341 Kg	391 Kg
BTR 365	365,000 BTR/Hr	85 Gal	79.50"	4.50"	70.25"	62.50"	22.50"	23"	3/4"	63.00	8"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	725 Lbs	833 Lbs
	107 kW/Hr	322 L	202 cm	12 cm	178 cm	159 cm	57 cm	58 cm	3/4"	160 cm	20 cm	70 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	329 Kg	379 Kg
BTR 400	399,000 BTR/Hr	100 Gal	75.50"	4.50"	67.50"	58.25"	26.75"	23"	3/4"	59.00"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	760 Lbs	874 Lbs
	117 kW/Hr	379 L	192 cm	12 cm	171 cm	148 cm	68 cm	58 cm	3/4"	150 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	345 Kg	396 Kg
BTR 500	500,000 BTR/Hr	85 Gal	82.25"	4.50"	73.50"	65.25"	25.50"	21"	1"	65.75	8"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	745 Lbs	857 Lbs
	147 kW/Hr	322L	209 cm	12 cm	187 cm	166 cm	65 cm	53 cm	1"	167 cm	20 cm	70 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	338 Kg	389 Kg

BTRC MODELS 120 THROUGH 500/A - TABLE 1B

MODEL	INPUT RATE BTU/Hr.	APPROX. TANK CAP.	A	B	C	D	E	F	GAS INLET G	H	VENT DIA I	J	CONNECTIONS INLET TOP	INLET FRONT	INLET BACK	OUTLET TOP	OUTLET FRONT	OUTLET BACK	Approximate ship. Weight STD.	ASME
BTRC120	120,000 BTU/Hr.	71 Gal	69.75"	4.25"	59.50"	50.87"	19.69"	19"	1/2"	51.88"	5"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	400 LBS	NA
	35 Kw/Hr	268 L	177 cm	11 cm	151 cm	129 cm	50 cm	48 cm	1/2"	132 cm	13 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	182 Kg	NA
BTRC154	154,000 BTU/Hr	81 Gal	73.00"	4.25"	66.50"	57.87"	19.69"	19"	1/2"	59.00"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 LBS	NA
	45 Kw/Hr	307 L	185 cm	11 cm	169 cm	147 cm	50 cm	48 cm	1/2"	150 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTRC180	180,000 BTU/Hr	76 Gal	70.50"	4.25"	63.75"	55.13"	17.75"	19"	1/2"	56.50"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 LBS	NA
	53 Kw/Hr	288 L	179 cm	11 cm	162 cm	140 cm	45 cm	48 cm	1/2"	144 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTRC197	199,000 BTR/Hr	95 Gal	81.50"	4.25"	74.75"	66.13"	17.75"	19"	1/2"	67.50"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	603 LBS	NA
	58 kW/Hr	360 L	207 cm	11 cm	190 cm	168 cm	45 cm	48 cm	1/2"	171 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	273 Kg	NA
BTRC199	190,000 BTR/Hr	76 Gal	70.50"	4.25"	63.75"	55.13"	17.75"	19"	1/2"	56.50"	6"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	470 LBS	NA
	56 kW/Hr	288 L	179 cm	11 cm	162 cm	140 cm	45 cm	48 cm	1/2"	144 cm	15 cm	71 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	213 Kg	NA
BTRC200	199,000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	6"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 lbs	725 lbs
	58 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	15 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTRC250	250000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 lbs	725 lbs
	72 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTRC251	251000 BTR/Hr	65 Gal	75.00"	4.50"	65.75"	57.25"	20.00"	NA	1/2"	58.8	8"	27.75"	NA	1.50"	1.50"	NA	1.50"	1.50"	750 lbs	862 lbs
	73 kW/Hr	246 L	191 cm	12 cm	167 cm	145 cm	51 cm	NA	1/2"	149 cm	20 cm	70 cm	NA	1.50"	1.50"	NA	1.50"	1.50"	341 Kg	391 Kg
BTRC275	275,000 BTR/Hr	100 Gal	72.00"	4.50"	65.13"	55.87"	19.75"	23"	1/2"	56.38"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	630 lbs	725 lbs
	80 kW/Hr	379 L	183 cm	12 cm	165 cm	142 cm	50 cm	58 cm	1/2"	143 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	286 Kg	329 Kg
BTRC305	305,000 BTR/Hr	65 Gal	75.00"	4.50"	65.75"	57.25"	20.00"	NA	1/2"	58.8	8"	27.75"	NA	1.50"	1.50"	NA	1.50"	1.50"	750 lbs	862 lbs
	89 kW/Hr	246 L	191 cm	12 cm	167 cm	145 cm	51 cm	NA	1/2"	149 cm	20 cm	70 cm	NA	1.50"	1.50"	NA	1.50"	1.50"	341 Kg	391 Kg
BTRC365	365,000 BTR/Hr	65 Gal	75.00"	4.50"	65.75"	57.25"	20.00"	NA	3/4"	58.8	8"	27.75"	NA	1.50"	1.50"	NA	1.50"	1.50"	750 lbs	862 lbs
	107 kW/Hr	246 L	191 cm	12 cm	167 cm	145 cm	51 cm	NA	3/4"	149 cm	20 cm	70 cm	NA	1.50"	1.50"	NA	1.50"	1.50"	341 Kg	391 Kg
BTRC400	399,000 BTR/Hr	100 Gal	75.50"	4.50"	67.50"	58.25"	26.75"	23"	3/4"	59.00"	8"	30.25"	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	760 lbs	874 lbs
	117 kW/Hr	379 L	192 cm	12 cm	171 cm	148 cm	68 cm	58 cm	3/4"	150 cm	20 cm	77 cm	1.50"	2.00"	2.00"	1.50"	2.00"	2.00"	345 Kg	396 Kg
BTRC500	500,000 BTR/Hr	85 Gal	82.25"	4.50"	73.50"	65.25"	25.50"	21"	1"	65.8	8"	27.75"	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	745 lbs	857 lbs
	147 kW/Hr	322L	209 cm	12 cm	187 cm	166 cm	65 cm	53 cm	1"	167 cm	20 cm	70 cm	1.50"	1.50"	1.50"	1.50"	1.50"	1.50"	338 Kg	389 Kg

TABLE 1C - HEATER PERFORMANCE DATA BTR MODELS

MODEL	INPUT RATE BTUH	APPROX. GAL CAP.	EFF. %	RECOVERY RATING CAPACITIES (GPH AND LPH)											
				30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F	140° F
				(-) 1 C	4 C	10 C	15 C	21 C	27 C	32 C	38 C	43 C	49 C	54 C	60 C
BTR	120,000 BTUH	71 Gal	80	388	291	233	194	166	145	129	116	106	97	90	83
120	35 Kw/Hr	268 L		1469	1102	882	734	628	549	488	439	401	367	341	314
BTR	154,000 BTUH	81 Gal	80	498	373	299	249	213	187	166	149	136	124	115	107
154	45 Kw/Hr	306 L		1885	1412	1132	943	806	708	628	564	515	469	435	405
BTR	180,000 BTUH	81 Gal	80	579	434	347	289	248	217	193	174	158	145	134	124
180	53 Kw/Hr	306L		2192	1643	1314	1094	939	821	731	659	598	549	507	469
BTR	199,000 BTUH	100 Gal	80	643	482	386	322	276	241	214	193	175	161	148	132
197	58 Kw/Hr	379 L		2434	1825	1461	1219	1045	912	810	731	662	609	560	500
BTR	199,000 BTUH	100 Gal	80	643	482	386	322	276	241	214	193	175	161	148	132
198	58 Kw/Hr	379L		2434	1825	1461	1219	1045	912	810	731	662	609	560	500
BTR	190,000 BTUH	81 Gal	80	614	461	368	307	263	230	205	184	167	154	142	132
199	56 Kw/Hr	306 L		2324	1745	1393	1162	996	871	776	697	632	583	538	500
BTR	199,000 BTUH	100 Gal	80	643	482	386	322	276	241	214	193	175	161	148	132
200	58 Kw/Hr	379 L		2434	1825	1461	1219	1045	912	810	731	662	609	560	500
BTR	250,000 BTUH	100 Gal	80	808	606	485	404	346	303	269	242	220	202	186	173
250	73 Kw/Hr	379 L		3059	2294	1835	1529	1311	1147	1020	918	834	765	706	655
BTR	251,000 BTUH	65 Gal	80	811	608	487	406	348	304	270	243	221	203	187	174
251	73 Kw/Hr	246 L		3071	2303	1843	1536	1316	1152	1024	921	838	768	709	658
BTR	275,000 BTUH	100 Gal	80	889	667	533	444	381	333	296	267	242	222	205	190
275	80 Kw/Hr	379 L		3365	2524	2019	1682	1442	1262	1122	1009	918	841	776	721
BTR	305,000 BTUH	65 Gal	80	986	739	592	493	423	370	329	296	269	246	228	211
305	89 Kw/Hr	246 L		3732	2799	2239	1866	1599	1399	1244	1120	1018	933	861	800
BTR	365,000	85 Gal	80	1180	885	708	590	506	442	393	354	322	295	272	253
365	107 Kw/Hr	322 L		4466	3349	2680	2233	1914	1675	1489	1340	1218	1116	1031	957
BTR	399,000 BTUH	100 Gal	80	1293	970	776	646	554	485	431	388	353	323	298	277
400	117 Kw/Hr	379 L		4894	3671	2936	2447	2097	1835	1631	1468	1335	1224	1129	1049
BTR	500,000 BTUH	85 Gal	80	1616	1212	970	808	693	606	539	485	441	404	373	346
500	147 Kw/Hr	322 L		6118	4588	3671	3059	2622	2294	2039	1835	1668	1529	1412	1311

TABLE 1D - HEATER PERFORMANCE DATA BTR(C) MODELS

MODEL	INPUT RATE BTUH	APPROX. GAL CAP.	EFF. %	RECOVERY RATING CAPACITIES (GPH AND LPH)											
				30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F	140° F
				(-) 1 C	4 C	10 C	15 C	21 C	27 C	32 C	38 C	43 C	49 C	54 C	60 C
BTRC	120,000 BTUH	71 Gal	80	388	291	233	194	166	145	129	116	106	97	90	83
120	35 Kw/Hr	268 L		1469	1102	882	734	628	549	488	439	401	367	341	314
BTRC	154,000 BTUH	81 Gal	80	498	373	299	249	213	187	166	149	136	124	115	107
154	45 Kw/Hr	306 L		1885	1412	1132	943	806	708	628	564	515	469	435	405
BTRC	180,000 BTUH	76 Gal	80	579	434	347	289	248	217	193	174	158	145	134	124
180	53 Kw/Hr	288L		2192	1643	1314	1094	939	821	731	659	598	549	507	469
BTRC	199,000 BTUH	95 Gal	80	643	482	386	322	276	241	214	193	175	161	148	132
197	58 Kw/Hr	360 L		2434	1825	1461	1219	1045	912	810	731	662	609	560	500
BTRC	190,000 BTUH	76 Gal	80	614	461	368	307	263	230	205	184	167	154	142	132
199	56 Kw/Hr	288 L		2324	1745	1393	1162	996	871	776	697	632	583	538	500
BTRC	199,000 BTUH	100 Gal	80	643	482	386	322	276	241	214	193	175	161	148	132
200	58 Kw/Hr	379 L		2434	1825	1461	1219	1045	912	810	731	662	609	560	500
BTRC	250,000 BTUH	100 Gal	80	808	606	485	404	346	303	269	242	220	202	186	173
250	73 Kw/Hr	379 L		3059	2294	1835	1529	1311	1147	1020	918	834	765	706	655
BTRC	251,000 BTUH	65 Gal	80	811	608	487	406	348	304	270	243	221	203	187	174
251	73 Kw/Hr	246 L		3071	2303	1843	1536	1316	1152	1024	921	838	768	709	658
BTRC	275,000 BTUH	100 Gal	80	889	667	533	444	381	333	296	267	242	222	205	190
275	80 Kw/Hr	379 L		3365	2524	2019	1682	1442	1262	1122	1009	918	841	776	721
BTRC	305,000 BTUH	65 Gal	80	986	739	592	493	423	370	329	296	269	246	228	211
305	89 Kw/Hr	246 L		3732	2799	2239	1866	1599	1399	1244	1120	1018	933	861	800
BTRC	360,000 BTUH	65 Gal	80	1164	873	698	582	499	436	388	349	317	291	269	249
365	105 Kw/Hr	246 L		4405	3304	2643	2202	1888	1652	1468	1321	1201	1101	1016	944
BTRC	399,000 BTUH	100 Gal	80	1293	970	776	646	554	485	431	388	353	323	298	277
400	117 Kw/Hr	379 L		4894	3671	2936	2447	2097	1835	1631	1468	1335	1224	1129	1049
BTR	500,000 BTUH	85 Gal	80	1616	1212	970	808	693	606	539	485	441	404	373	346
500	147 Kw/Hr	322 L		6118	4588	3671	3059	2622	2294	2039	1835	1668	1529	1412	1311

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FOREWORD

These designs comply with ANSI Z21.10.3/CSA 4.3 M98 as an automatic circulating or automatic storage tank type water heater.

Heaters having an input of 305,000 (89 Kwh), 365,000 (107 Kwh), 399,000 (117 Kwh) and 500,000 (147 Kwh) Btuh with a recovery rating of 277.3 gph (1049 Lph) or more also comply with ANSI Z21.10.3 as an automatic instantaneous type heater.

Detailed installation diagrams are found in this manual. These diagrams will serve to provide the installer with a reference for the materials and methods of piping necessary. It is highly essential that all water, gas piping and wiring be installed as shown on the diagrams.

Particular attention should be given to the installation of thermometers at the locations indicated on the diagrams as these are necessary for checking the proper functioning of the heater.

The heater is designed to operate on natural or propane gases. HOWEVER, MAKE SURE the gas on which the heater will operate is the same as that specified on the heater model and rating plate.

These heaters may be installed on combustible floors.

In addition to these instructions, the equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

The installation must conform to these instructions and the local code authority having jurisdiction. In the absence of local codes, the installation must comply with the latest editions of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and the National Electrical Code, NFPA 70, CAN/CSA 149.1 or .2, and CSA 2 C22.1. The former is available from the Canadian Standards Association, 8501 East Pleasant Valley Road, Cleveland, OH 44131, and both documents are available from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

GENERAL SAFETY INFORMATION

PRECAUTIONS

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. Immediately call a qualified service techincian to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

IF THE UNIT IS EXPOSED TO THE FOLLOWING, DO NOT OPERATE HEATER UNTIL ALL CORRECTIVE STEPS HAVE BEEN MADE BY A QUALIFIED SERVICEMAN.

1. EXTERNAL FIRE.
2. DAMAGE.
3. FIRING WITHOUT WATER.
4. SOOTING

CHEMICAL VAPOR CORROSION

WARNING

CORROSION OF THE FLUEWAYS AND VENT SYSTEM MAY OCCUR IF AIR FOR COMBUSTION CONTAINS CERTAIN CHEMICAL VAPORS. SUCH CORROSION MAY RESULT IN FAILURE AND RISK OF ASPHYXIATION.

Spray can propellants, cleaning solvents, refrigerator and air conditioning refrigerants, swimming pool chemicals, calcium and sodium chloride (water softener salt), waxes, and process chemicals and typical compounds which are potentially corrosive. Do not store products of this sort near the heater. Also, air which is brought in contact with a the heater should not contain any of these chemicals. If necessary, uncontaminated air should be obtained from remote or outside sources. The limited warranty is voided when failure of water heater is due to a corrosive atmosphere. (Refer to the limited warranty for complete terms and conditions.

IMPROPER COMBUSTION

WARNING

ATTIC AND/OR EXHAUST FANS OPERATING ON THE PREMISES WITH A WATER HEATER CAN RESULT IN CARBON MONOXIDE POISONING AND DEATH.

OPERATION OF THESE FANS CAN PRODUCE A NEGATIVE DRAFT IN THE AREA OF THE WATER HEATER PREVENTING THE PRODUCTS OF COMBUSTION FROM EXHAUSTING THROUGH THE CHIMNEY OR VENT PIPE.

The venting of the water heater should be inspected by a qualified service technician at the time of installation and periodically thereafter to ensure a down-draft condition does not exist.

DO NOT OBSTRUCT THE FLOW OF COMBUSTION AND VENTILATING AIR. ADEQUATE AIR FOR COMBUSTION AND VENTILATION MUST BE PROVIDED FOR SAFE OPERATION.

LIQUID PETROLEUM MODELS

Water heaters for propane or liquefied petroleum gas (LPG) are different from natural gas models. A natural gas heater will not function safely on LP gas and no attempt should be made to convert a heater from natural gas to LP gas.

LP gas must be used with great caution. It is highly explosive and heavier than air. It collects first in the low areas making its odor difficult to detect at nose level. If LP gas is present or even suspected, do not attempt to find the cause yourself. Go to a neighbor's house, leaving your doors open to ventilate the house, then call your gas supplier or service agent. Keep area clear until a service call has been made.

At times you may not be able to smell an LP gas leak. One cause is odor fade, which is a loss of the chemical odorant that gives LP gas its distinctive smell. Another cause can be your physical condition, such as having a cold or diminishing sense of smell with age. For these reasons, the use of a propane gas detector is recommended.

IF YOU EXPERIENCE AN OUT-OF-GAS SITUATION, DO NOT TRY TO RELIGHT APPLIANCES YOURSELF, Ask your LP delivery person to relight pilots for you. Only trained LP professionals should conduct the required safety checks in accordance with industry standards.

EXTENDED NON-USE PERIODS

WARNING

HYDROGEN GAS CAN BE PRODUCED IN A HOT WATER SYSTEM SERVED BY THIS HEATER THAT HAS NOT BEEN USED FOR A LONG PERIOD OF TIME (GENERALLY TWO WEEKS OR MORE). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To reduce the risk of injury under these conditions, it is recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. If hydrogen is present, there will probably be an unusual sound such as air escaping through the pipe as the water begins to flow. THERE SHOULD BE NO SMOKING OR OPEN FLAME NEAR THE FAUCET AT THE TIME IT IS OPEN.

INSULATION BLANKETS

Insulation blankets available to the general public for external use on gas water heaters are not approved for use on your A.O. Smith water heater. The purpose of an insulation blanket is to reduce the standby heat loss encountered with storage tank water heaters. Your A.O. Smith water heater meets or exceeds the ASHRAE/IES 90.1b-1992 standards with respect to insulation and standby loss requirement making an insulation blanket unnecessary.

WARNING

Should you choose to apply an insulation blanket to this heater, you should follow these instructions. Failure to follow these instructions can result in fire, asphyxiation , serious personal injury or death.

- Do not apply insulation to the top of the water heater, as this will interfere with safe operation of drafthood.

- Do not cover the temperature & pressure relief valve.
- Do not cover the instruction manual. Keep it on the side of the water heater or nearby for future reference.
- Do obtain new labels from A.O. Smith for placement on the blanket directly over the existing labels.

HIGH ALTITUDE INSTALLATIONS

⚠ WARNING

INSTALLATIONS ABOVE 2000 FEET (610 METERS) REQUIRE REPLACEMENT OF THE BURNER ORIFICE IN ACCORDANCE WITH SECTION 8.1.2 OF THE NATIONAL FUEL GAS CODE (ANSI Z223.1). FOR CANADIAN INSTALLATIONS CONSULT CANADIAN INSTALLATIONS CODES AND CAN/CSA B149.1 OR .2. FAILURE TO REPLACE THE ORIFICE WILL RESULT IN IMPROPER AND INEFFICIENT OPERATION OF THE APPLIANCE RESULTING IN THE PRODUCTION OF INCREASED LEVELS OF CARBON MONOXIDE GAS IN EXCESS OF SAFE LIMITS WHICH COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

You should contact your gas supplier for any specific changes which may be required in your area.

As elevation above sea level is increased, there is less oxygen per cubic foot of air. Therefore, the heater input rate should be reduced at high altitudes for satisfactory operation with the reduced oxygen supply. Failure to make this reduction would result in an overfiring of the heater causing sooting, poor combustion and/or unsatisfactory heater performance.

U.S. REQUIREMENTS

Ratings specified by manufacturers for most appliances apply for elevations up to 2000 feet (610m). For elevations above 2000 feet (610), ratings must be reduced at the rate of 4% for each 1000 feet (305m) above sea level. For example, if a heater is rated at 120,000 Btuh (35 Kwh) at sea level, to rate the heater at 4000 feet (1219m), you subtract 4 (once for each thousand feet) x.04 (4% input reduction) x 120,000 (original rating) from the original rating. Therefore, to calculate the input rating at 4,000 feet (121.9m): 4 x .04 x 120,000 =19,200 Btuh (5.6 Kwh), 120,000 (35 Kwh) - 19,200 (5.6 Kwh) = 100,800 Btuh (29.4 Kwh). At 6000 feet (1829m) the correct input rating should be 91,200 Btuh (26.7 Kwh).

CANADIAN REQUIREMENTS

Appliances with inputs up to and including 400,000 BTU must be factory equipped with orifices for operation at specific elevations. Standard (sea level) orifices permit operation up to 2000' (610m) elevation. For operation between 2000' (610m) and 4500' (1370m) specify "HIGH ALTITUDE OPERATION" when ordering the heater(s). For operation above 4500' (2370m) consult factory before ordering.

Field conversion for operation at altitudes other than that specified on the heater rating plate is not permitted.

The input reduction is primarily achieved by reducing the size of the main burner orifices. To do this, the main burner orifices require replacement with orifices sized for the particular installation elevation. Correct orifice sizing and parts may be obtained from A.O. Smith Water Products Company. When ordering, be sure to state the model number and the altitude of the location where the water heater is being installed.

Upon completion of derating of the heater, adjustment to the gas pressure regulator may be required. See CHECKING THE INPUT section in this manual for inlet and manifold pressure requirements. Also due to the input rating reduction required at high altitudes, the output rating of the appliance is also reduced and should be compensated for in the sizing of the equipment for application.

FEATURES

HIGH LIMIT SWITCH (E.C.O.)

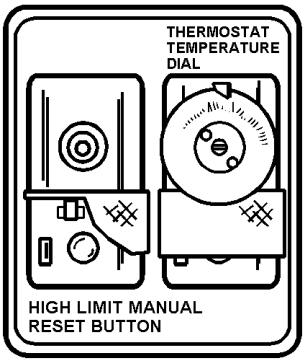
The dual bulb controller (fig. 2) contains the high limit (energy cutoff) sensor. The high limit switch interrupts main burner gas flow should the water temperature reach 205˚F (96°C).

In the event of high limit switch operation, the appliance cannot be restarted unless the water temperature is reduced by at least 20^{0}F (11°C) and the high limit reset button on front of limit control (fig. 2) is depressed.

Continued manual resetting of high limit control, preceded by higher than usual water temperature is evidence of high limit switch operation. The following are possible reasons for high limit switch operation.

- A malfunction in the thermostatic controls would allow the gas valve to remain open causing water temperature to exceed the thermostat setting. The water temperature would continue to rise until high limit switch operation.

Contact your dealer or servicer if continued high limit switch operation occurs.

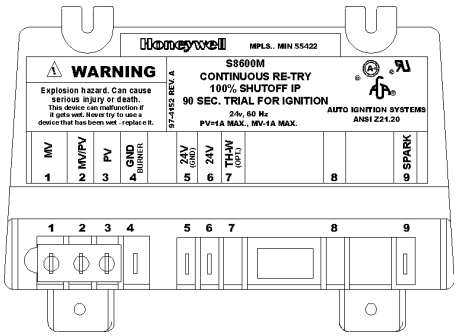


DUAL-BULB THERMOSTAT
(COVER REMOVED)
FIGURE 2

Continued pilot outage preceded by higher than usual water temperature is evidence of high limit switch operation. Contact your dealer or servicer to determine the reason for operation.

ELECTRONIC IGNITION CONTROL

Each heater is equipped with a Honeywell ignition module. The solid state ignition control, fig.3, ignites the pilot burner gas by creating a spark at the pilot assembly. Pilot gas is ignited and burns during each running cycle. The main burner and pilot gases are cut off during the OFF cycle. Pilot gas ignition is proven by the pilot sensor. Main burner ignition will not occur if the pilot sensor does not first sense pilot ignition.



HONEYWELL IGNITION MODULE
S8600M Continuous Re-Try
FIGURE 3

AUTOMATIC FLUE DAMPER DEVICE

All units are equipped with an automatic flue damper that reduces heat loss during the OFF cycles. The automatic flue damper drive motor and circuit board are field replaceable parts and may be obtained by contacting A. O. Smith Water Products Company, Product Service Division, 5621 W. 115th Street, Alsip, IL 60803, 1-800-433-2545, for Canada contact A.O. Smith Enterprises LTD., P.O. Box, 310 - 768 Erie Street, Stratford, Ontario, Canada N5A 6T3, 519-271-5800.

Each automatic flue damper drive assembly is equipped with a "NORMAL/SERVICE switch, fig. 4. This switch is mounted on the drive unit circuit board and can be accessed by removing the damper drive assembly cover. When the switch is placed in the "SERVICE" position the automatic flue damper drive motor is disconnected but the damper disc position switch remains in circuit. If the damper disc, located inside the drafthood, is not visibly in the vertical position it must be manually moved to the vertical position and secured there. The damper disc must be vertical to complete the damper disc safety interlock.

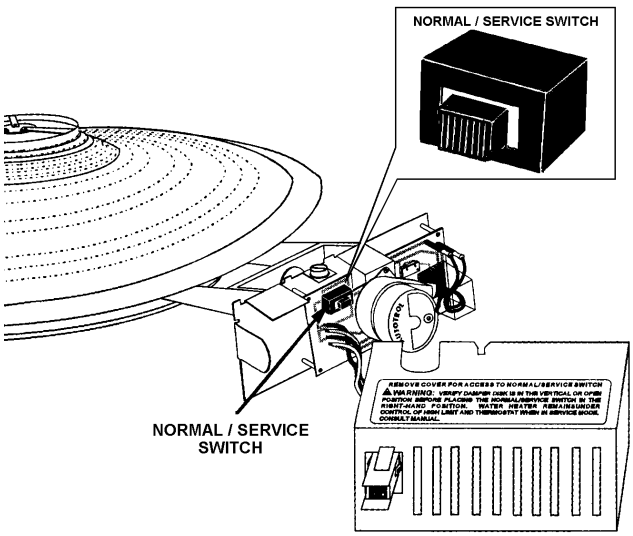


FIGURE 4

In the "SERVICE" position and with the damper disc vertical, the water heater can be operated, tested or serviced in a normal, safe manner. In the "SERVICE" position, the water heater remains under control of the ECO and thermostat.

If the water heater runs satisfactorily with the switch in the "SERVICE" position, then follow suggestions in the ***Troubleshooting-Flue Damper Drive Unit*** section of this manual. If the water heater does not run with the switch in the "SERVICE" position, then follow the suggestions in the ***Troubleshooting-Ignition Module System*** *and* ***Operational Checklist*** sections of this manual.

CIRCULATING PUMP

A circulating pump is used when a system requires a circulating loop or there is a storage tank used in conjunction with the heater. Refer to the piping diagrams at rear of manual for electrical hookup information and install in accordance with the latest version of the National Electric Code ANSI/NFPA No. 70. For Canada refer to Canadian Code CSA C22.1.

Only all bronze circulators are used with commercial water heaters.

Although circulators are oiled and operated by the manufacturer some circulators must be oiled again before operating. Please refer to manufacturer's instructions.

DISHWASHING MACHINE REQUIREMENT

These appliances meet the National Sanitation Foundation Standard for sanitary installations when used with the following leg kits, Part No's. 6570-0 and 6570-7.

All dishwashing machines meeting the National Sanitation Foundation requirements are designed to operate with water flow pressures between 15 and 25 psi (103Kpa and 173 Kpa). Flow pressures above 25 psi (173Kpa), or below 15 psi (103 Kpa), will result in improperly sanitized dishes. Where pressures are high, a water pressure reducing or flow regulating control valve should be used in 180^{0}F line to the dishwashing machine, and should be adjusted to deliver water between these limits.

The National Sanitation Foundation also recommends circulation of 180^{0}F (82°C) water. Where this is done, the circulation should be very gentle so that it does not cause any unnecessary turbulence inside the water heater. The circulation should be just enough to provide 180^{0}F (82°C) water at the point of take-off to the dishwashing machine. Adjust flow by means of the plug cock in the circulating line.

INSTALLATION INSTRUCTIONS

REQUIRED ABILITY

INSTALLATION OR SERVICE OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN IN THE FIELD INVOLVED. PLUMBING, AIR SUPPLY, VENTING, GAS SUPPLY AND ELECTRICAL WORK ARE REQUIRED.

WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

UNCRATING

The heater is shipped with a draft hood diverter already installed. The wiring conduit runs from the thermostat to the damper drive cover. Before turning unit on, check to make sure the wiring conduit is securely plugged into damper drive.

LOCATING THE HEATER

WARNING

THERE IS A RISK IN USING FUEL BURNING APPLIANCES SUCH AS GAS WATER HEATERS IN ROOMS, GARAGES OR OTHER AREAS WHERE GASOLINE, OTHER FLAMMABLE LIQUIDS OR ENGINE DRIVEN EQUIPMENT OR VEHICLES ARE STORED, OPERATED OR REPAIRED. FLAMMABLE VAPORS ARE HEAVY AND TRAVEL ALONG THE FLOOR AND MAY BE IGNITED BY THE HEATER'S PILOT OR MAIN BURNER FLAMES CAUSING FIRE OR EXPLOSION. SOME LOCAL CODES PERMIT OPERATION OF GAS APPLIANCES IN SUCH AREAS IF THEY ARE INSTALLED 18" (.50m) OR MORE ABOVE THE FLOOR. THIS MAY REDUCE THE RISK IF LOCATION IN SUCH AN AREA CANNOT BE AVOIDED.

DO NOT INSTALL THIS WATER HEATER DIRECTLY ON A CARPETED FLOOR. A FIRE HAZARD MAY RESULT. Instead the water heater must be placed on a metal or wood panel extending beyond the full width and depth by at least 3 inches (7.6cm) in any direction. If the heater is installed in a carpeted alcove, the entire floor shall be covered by the panel. Also, see the DRAIN REQUIREMENTS.

THE HEATER SHALL BE LOCATED OR PROTECTED SO IT IS NOT SUBJECT TO PHYSICAL DAMAGE BY A MOVING VEHICLE.

WARNING

FLAMMABLE ITEMS, PRESSURIZED CONTAINERS OR ANY OTHER POTENTIAL FIRE HAZARDOUS ARTICLES MUST NEVER BE PLACED ON OR ADJACENT TO THE HEATER. OPEN CONTAINERS OR FLAMMABLE MATERIAL SHOULD NOT BE STORED OR USED IN THE SAME ROOM WITH THE HEATER.

When installing the heater, consideration must be given to proper location. Location selected should be as close to the stack or chimney as practicable, with adequate air supply and as centralized with the piping system as possible.

THE HEATER MUST NOT BE LOCATED IN AN AREA WHERE IT WILL BE SUBJECT TO FREEZING.

LOCATE IT NEAR A FLOOR DRAIN. THE HEATER SHOULD BE LOCATED IN AN AREA WHERE LEAKAGE FROM THE HEATER OR CONNECTIONS WILL NOT RESULT IN DAMAGE TO THE ADJACENT AREA OR TO LOWER FLOORS OF THE STRUCTURE.

WHEN SUCH LOCATIONS CANNOT BE AVOIDED, A SUITABLE DRAIN PAN SHOULD BE INSTALLED UNDER THE HEATER. Such pans should be fabricated with sides at least 2" (5cm) deep, with length and width at least 2" (5cm) greater than the diameter of the heater and must be piped to an adequate drain. The pan must not restrict combustion air flow.

For appliance installation locations with elevations above 2000 feet (610m), refer to HIGH ALTITUDE INSTALLATIONS section of this manual for input reduction procedure.

LEVELING

If the unit is not level, insert the bolts which were used in crating into the legs to correct this condition.

CLEARANCES

These heaters are approved for installation on combustible flooring in an alcove when the minimum clearance from any combustion construction are followed as indicated in figure 6 and Table 1. The following units are approved for installation with side, rear and ceiling clearances as indicated below:

	A (RIGHT SIDE)	B (LEFT SIDE)	C (BACK)	D (CEILING)
120	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.48 cm)
154	1" (2.54 cm)	1" (2.5 cm)	1" (2.5 cm)	12" (30.48 cm)
*180	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.48 cm)
*197	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.48 cm)
198	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.48 cm)
*199	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.48 cm)
200	1" (2.54 cm)	1" (2.54 cm)	1" (2.54 cm)	12" (30.4 8cm)
250	2" (5.08 cm)	2" (5.08 cm)	2" (5.08 cm)	12" (30.4 8cm)
251	2" (5.08 cm)	2" (5.08 cm)	2" (5.08 cm)	12" (30.4 8cm)
275	2" (5.08 cm)	2" (5.08 cm)	2" (5.08 cm)	12" (30.4 8cm)
305	2" (5.08 cm)	2" (5.08 cm)	2" (5.08 cm)	12" (30.4 8cm)
**365	3" (7.75 cm)	3" (7.75 cm)	3" (7.75 cm)	12" (30.4 8cm)
400	3" (7.75 cm)	3" (7.75 cm)	3" (7.75 cm)	12" (30.4 8cm)
500	5" (12.7 cm)	5" (12.7 cm)	5" (12.7 cm)	20" (50.80 cm)

* The BTR(C) version has a 2" (5.08 cm) to sides and rear
**The BTR(C) version has a 4" (10.16 cm) to sides and rear

TABLE 2

In all installations the minimum combustible clearances from any draft hood surface or vent piping shall be 6" (16cm). Vent piping passing through a combustible wall or ceiling must be a continuous run (no joints) and retain the 6" (16cm) clearance unless an approved reducing thimble is used.

A service clearance of 24" (61cm) should be maintained from serviceable parts, such as relief valves, flue baffles, flue damper devices, thermostats, cleanout openings or drain valves.

HARD WATER

Where hard water conditions exist, water softening or the threshold type of water treatment is recommended. This will protect the dishwashers, coffee urns, water heaters, water piping and other equipment.

See MAINTENANCE section for details of tank cleanout procedure.

AIR REQUIREMENTS

REFER TO THE LATEST EDITION OF THE "NATIONAL FUEL GAS CODE" ANSI Z223.1/NFPA 54. FOR CANADA CONSULT CAN/CGA B149.1 OR .2.

KEEP APPLIANCE AREA CLEAR AND FREE OF COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLES, VAPORS AND LIQUIDS.

DO NOT OBSTRUCT THE FLOW OF COMBUSTION OR VENTILATING AIR.

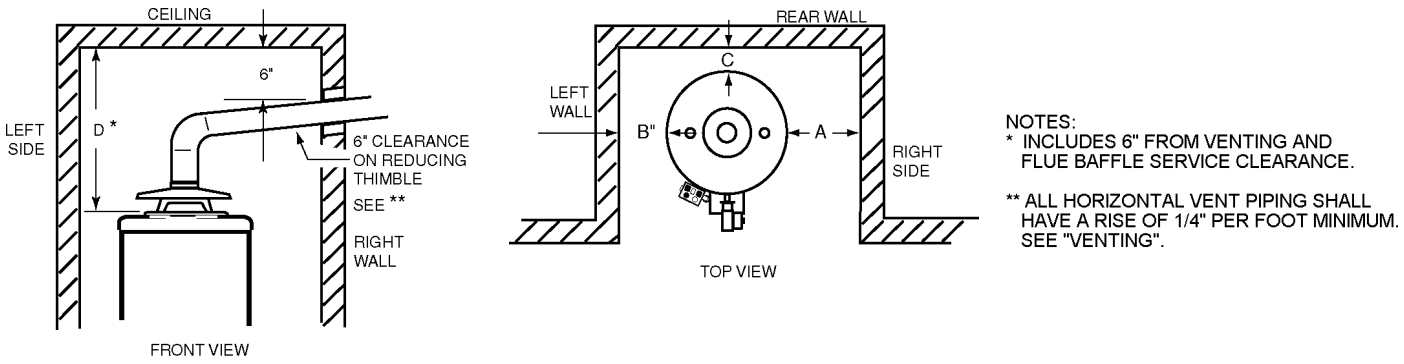


ILLUSTRATION OF MINIMUM COMBUSTIBLE CLEARANCES IN AN ALCOVE

FIGURE 5

WARNING

FOR SAFE OPERATION PROVIDE ADEQUATE AIR FOR COMBUSTION AND VENTILATION. AN INSUFFICIENT SUPPLY OF AIR WILL CAUSE RECIRCULATION OF COMBUSTION PRODUCTS RESULTING IN AIR CONTAMINATION THAT MAY BE HAZARDOUS TO LIFE. SUCH A CONDITION OFTEN WILL RESULT IN A YELLOW, LUMINOUS BURNER FLAME, CAUSING CARBONING OR SOOTING OF THE COMBUSTION CHAMBER, BURNERS AND FLUE TUBES AND CREATES A RISK OF ASPHYXIATION.

Where an exhaust fan is supplied in the same room with a heater, sufficient openings for air must be provided in the walls. UNDERSIZED OPENINGS WILL CAUSE AIR TO BE DRAWN INTO THE ROOM THROUGH THE CHIMNEY, CAUSING POOR COMBUSTION. SOOTING MAY RESULT IN SERIOUS DAMAGE TO THE HEATER AND RISK OF FIRE OR EXPLOSION.

UNCONFINED SPACE

In buildings of conventional frame, brick, or stone construction, unconfined spaces may provide adequate air for combustion, ventilation and draft hood dilution.

If the unconfined space is within a building of tight construction (buildings using the following construction: weather stripping, heavy insulation, caulking, vapor barrier, etc.), air for combustion, ventilation and draft hood dilution must be obtained from outdoors. The installation instructions for confined spaces in tightly constructed buildings must be followed to ensure adequate air supply.

CONFINED SPACE

When drawing combustion and dilution air from inside a conventionally constructed building to a confined space, such a space shall be provided with two permanent openings, ONE IN OR WITHIN 12 INCHES (30.48cm) OF THE ENCLOSURE TOP AND ONE IN OR WITHIN 12 INCHES (30.48cm) OF THE ENCLOSURE BOTTOM. Each opening shall have a free area of at least one square inch per 1000 Btuh (6.45 square cm) of the total input of all appliances in the enclosure, but not less than 100 square inches (645 square cm, 293 Kwh).

If the confined space is within a building of tight construction, air for combustion, ventilation, and draft hood dilution must be obtained from outdoors. When directly communicating with the outdoors or communicating with the outdoors through vertical ducts, two permanent openings, located in the above manner, shall be provided. Each opening shall have a free area of not less than one square inch (6.45 square cm) per 4000 Btuh (1.17 Kwh) of the total input of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of not less than one square inch (6.45 square cm) per 2000 Btuh (.58 Kwh) of the total input of all appliances in the enclosure. For Canadian installations consult CAN/CSA B149.1 or .2.

DRAFT DIVERTER INSTALLATION

Before turning on the appliance, examine the rating plate label on the appliance for reference to usable draft hood assemblies. Examine your draft hood assembly for an identification part number (label). If your draft hood assembly number does not match the draft hood assembly number found on the rating plate or if the draft hood assembly number is not shown to be a “replacement part” for the one on the rating plate - YOU HAVE THE WRONG DRAFT HOOD ASSEMBLY. Contact your supplier or distributor and order the “correct” draft hood assembly.

The draft hood furnished with this heater is already installed on the appliance. Provision must be made if it is installed in confined space or a small room to accommodate draft hood spillage and avoid risks described in previous steps. The upper air opening called for in the AIR REQUIREMENTS section of this manual is for this purpose. See “FEATURES-AUTOMATIC FLUE DAMPER DEVICE” for additional information.

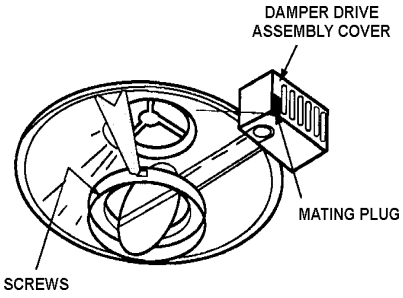


FIGURE 6

Please pay attention to the following concerning the drafthood assembly.

- Keep conduit harness free of draft hood relief area and from unnecessary contact with drafthood.
- The electrical plug from the heater conduit harness can be attached only one way and the plug will lock in place when fully inserted.

- If service is require for the hood portion of the drafthood/ damper drive assembly, they may be separated by unfastening the three screws located in the cast iron base.

The flue damper must be in "OPEN" position when appliance pilot and/or main burners are operating.

The top of the damper blade is visible when the damper is in the "open" (vertical) position. The flue damper is intended to close during heater "OFF" cycle (stand-by).

VENT REDUCER

The BTR(C) 250, 251, and 275 models are shipped with an 8" to 6" diameter flue outlet adapter. The BTR(C) 120 models come with an 6" to 5" diameter flue outlet adapter. Each adapter fits on top of the installed flue damper. Use only vent reducers supplied with the unit. The venting must comply with the NATIONAL FUEL GAS CODE, ANSI Z223.1/NFPA 54 and for Canadian installations consult the Canadian Installation Code CAN/CGA B149.1 AND .2.

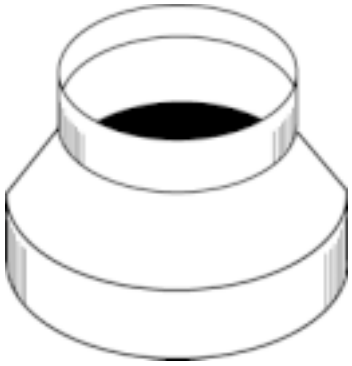


FIGURE 7

VENTING

WARNING

THE INSTRUCTIONS IN THIS SECTION ON VENTING MUST BE FOLLOWED TO AVOID CHOKED COMBUSTION OR RECIRCULATION OF FLUE GASES. SUCH CONDITIONS CAUSE SOOTING OR RISKS OF FIRE AND ASPHYXIATION.

Heater must be protected from freezing downdrafts.

Remove all soot or other obstructions from the chimney that will retard a free draft.

Type B venting is recommended with these heaters. See table VI FOR TYPICAL VENTING APPLICATION.

This water heater must be vented in compliance with all local codes, the current revision of the National Fuel Gas Code (ANSI-Z223.1) and with the Category I Venting Tables.

In Canada, venting shall conform to the requirements of the current CAN/CGA B149.1 or .2 installation code.

If any part of the vent system are exposed to ambient temperatures below 35 degrees F (2 degrees C) it must be insulated to prevent condensation.

The following steps shall be followed with each appliance connected to the venting system placed in operation, while any other appliances connected to the venting system are not in operation.

1. Seal any unused openings in the venting system.

2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1 or the CAN/CGA B149 Installation codes and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

3. So far as is practical, close all building doors and windows and all doors between the space in which the water heater(s) connected to the venting system are located and other spaces of the building. Turn on all appliances not connected to the venting system. Turn on all exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Close fireplace dampers.

4. Follow the lighting instruction. Place the water heater being inspected in operation. Adjust thermostat so appliance shall operate continuously.

5. Test for draft hood spillage at the relief opening after 5 minutes of main burner operation.

6. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.

7. If improper venting is observed during any of the above tests, the venting system must be corrected.

WARNING

FAILURE TO CORRECT BACK DRAFTS MAY CAUSE AIR CONTAMINATION AND UNSAFE CONDITIONS.

- If the back draft cannot be corrected by the normal method or if a suitable draft cannot be obtained, a blower type flue gas exhauster must be employed to assure proper venting and correct combustion.

- Do not connect the heater to a common vent or chimney with solid fuel burning equipment. This practice is prohibited by many local building codes as is the practice of venting gas fired equipment to the duct work of ventilation systems.

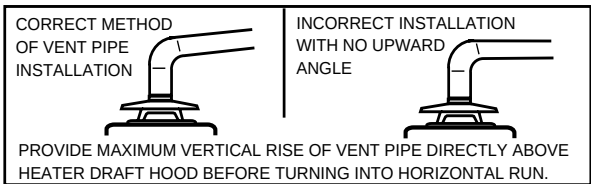

CORRECT METHOD OF VENT PIPE INSTALLATION
INCORRECT INSTALLATION WITH NO UPWARD ANGLE
PROVIDE MAXIMUM VERTICAL RISE OF VENT PIPE DIRECTLY ABOVE HEATER DRAFT HOOD BEFORE TURNING INTO HORIZONTAL RUN.

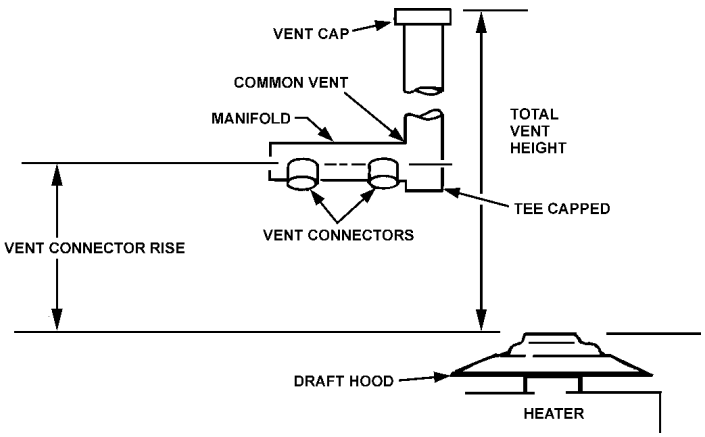
FIGURE 8

- Where a separate vent connection is not available and the vent pipe from the heater must be connected to a common vent with an oil burning furnace, the vent pipe should enter the smaller common vent or chimney at a point above the large vent pipe.

TECHNICAL DATA VENTING

TYPE B GAS VENT
Multiple Gas Fired Tank-Type Heaters

When venting mutiple tank type heaters using Type B vent pipe, follow the installation diagram (figure 4) and tables below which give sizing and data based upon NFPA 54/ANSI Z223. 1992.



MODEL BTR-120

Input: 120,00Btuh			**Total Vent Height (Feet)**							
Draft Hood: 5”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (inches)**							
	120,000	1 Ft.	7	7	7	6	6	6	6	6
	120,000	2 Ft.	6	6	6	6	6	6	6	5
	123,000	3 Ft.	6	6	6	6	6	5	5	5
Number of Heaters	**Combined Input in Thousands of Btuh**		**Manifold and Common Vent Diameter (In inches)**							
2	240		10	8	8	7	7	7	6	7
3	360		10	10	10	10	8	8	7	7
4	480		12	12	12	10	10	10	8	8

MODEL BTR-154

Input: 154,000 Btuh			**Total Vent Height (Feet)**							
Draft Hood: 6”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	154,000	1 Ft.	8	8	7	7	7	7	7	7
	154,000	2 Ft.	7	7	7	7	7	6	6	6
	154,000	3 Ft.	7	7	7	6	6	6	6	6
Numbers of Heaters	**Combined Input in Thousands of Btuh**		**Manifold and Common Vent Diameter (in inches)**							
2	308		10	10	10	8	8	7	7	7
3	462		12	12	12	10	10	10	8	8
4	618		14	14	12	12	12	10	10	10

MODEL BTR-180, 197, 198, 199, 200

Input: 180,000, 190,000, 199,000 Btuh			**Total Vent Height (Feet)**							
Draft Hood: 6”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	180,000	1 Ft.	8	8	8	8	8	7	7	7
	190,000		-	8	8	8	8	8	7	7
	199,000		-	-	8	8	8	8	8	7
	180,000	2 Ft.	8	8	7	7	7	7	7	7
	190,000		8	8	8	7	7	7	7	7
	199,000		8	8	8	8	7	7	7	7
	179,000	3 Ft.	7	7	7	7	7	7	6	6
	190,000		8	7	7	7	7	7	6	6
	197,000		8	7	7	7	7	7	7	6
	199,000		8	8	7	7	7	7	7	6
Number of Heaters	**Combined Input in Thousands of Btuh**		**Manifold & Common Vent Diameter**							
2	358		10	10	10	10	8	8	7	7
	380		12	10	10	10	10	8	7	7
	394/398		12	10	10	10	10	8	8	7
3	537		14	12	12	12	10	10	10	8
	570		14	12	12	12	10	10	10	10
	591/597		14	14	12	12	12	10	10	10
4	716		14	14	14	12	12	12	10	10
	760		16	14	14	14	12	12	10	10
	788/796		16	14	14	14	12	12	12	10

TECHNICAL DATA VENTING (Continued)

MODEL BTR-250, 251

Input: 250,000, 251,000			**Total Vent Height (Feet)**							
Draft Hood: 6”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	250/251,000	1 Ft.	-	-	-	-	-	-	8	8
	250/251,000		-	-	-	8	8	8	8	8
	250/251,000	3 Ft.	-	8	8	8	-	8	7	7
Number of Heaters	**Combined Input in Thousands of Btuh**		**Manifold and Common Vent Diameter (In inches)**							
2	480		14	12	12	10	10	10	8	8
	500/502		14	12	12	10	10	10	10	8
3	720		14	14	14	12	12	12	10	10
	750/753		16	14	14	14	12	12	10	10
4	960/1000/1004		18	16	16	14	14	14	12	12

MODEL BTR-275

Input: 275,000 Btuh			**Total Vent Height (Feet)**							
Draft Hood: 6”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	275,000	2 Ft.	-	-	-	-	-	8	8	8
	275,000	3 Ft.	-	-	-	8	8	8	8	8
Numbers of Heaters	**Combined Input in Thousands of Btuh**		**Manifold and Common Vent Diameter (in inches)**							
2	550		-	-	-	12	10	10	10	10
3	825		-	-	-	14	14	12	12	12
4	1100		-	-	-	16	14	14	12	12

MODEL BTR-305

Input: 305,000 Btuh			**Total Vent Height (Feet)**							
Draft Hood: 8”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	315,000	1 Ft.	-	-	10	10	10	10	10	10
	305,000	2 Ft.	10	10	10	10	10	10	8	8
	365,000	3 Ft.	10	10	10	10	10	8	8	8
Number of Heaters	**Combined Input in Thousands of Btuh**		**Manifold & Common Vent Diameter**							
2	610		14	14	12	12	12	10	10	10
3	915		16	16	16	14	14	12	12	12
4	1220		18	18	16	16	16	14	14	12

MODEL BTR-365, 400

Input: 365,000, 399,000			**Total Vent Height (Feet)**							
Draft Hood: 8”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	365,000	1 Ft.	-	-	-	-	-	10	10	10
	400,000		-	-	-	-	-	-	10	10
	365,000	2 FT.	12	12	10	10	10	10	10	10
	400,000		12	12	12	12	10	10	10	10
	365,000	3 FT.	10	10	10	10	10	10	10	10
	400,000		12	10	10	10	10	10	10	10
Number of Heaters	**Combined Input in Thousands of Btuh**		**Manifold & Common Vent Diameter (inches)**							
2	730		14	14	14	12	12	12	10	10
	800		16	14	14	14	12	12	10	10
3	1095		18	18	16	16	14	14	12	12
	1200		18	18	18	16	16	14	14	12
4	1460		20	20	18	18	16	16	14	12
	1600		22	20	20	18	18	16	14	14

MODEL BTR 500

Input: 500,000 Btuh			**Total Vent Height (Feet)**							
Draft Hood: 8”			6	8	10	15	20	30	50	100
	Input Btuh	**Rise**	**Vent Connector Diameter (in inches)**							
	500,000	2 Ft.	-	12	12	12	12	12	12	12
	500,000	4 Ft.	12	12	12	12	12	12	10	10
	500,000	6 Ft.	N/A	12	12	12	12	12	10	10
Number of Heaters	**Combined Input in Thousands of Btuh**		Manifold & Common Vent Diameter (inches)							
2	1000		18	16	16	14	14	14	12	12
3	1500		22	20	20	18	16	16	14	12
4	2000		24	22	22	20	20	18	16	14

MULTIPLE HEATER MANIFOLD

Figure 9 and tables on pages 11 and 12 should be used for horizontally manifolding two or more heaters. Also see MULTIPLE-UNIT INSTALLATIONS of MECHANICAL VENTING section for induced draft applications.

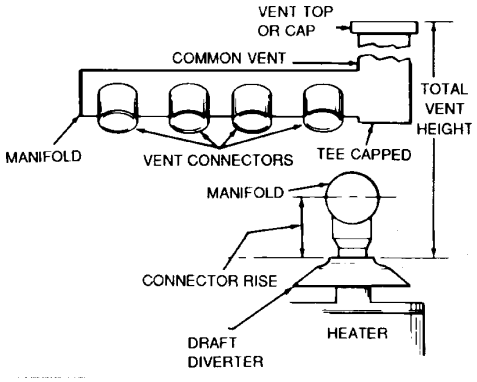


FIGURE 9

WATER LINE CONNECTIONS

This manual provides detailed installation diagrams (see pages 17 - 23 of this manual) for typical methods of application for the water heaters.

The water heater may be installed by itself, or with a separate storage tank, on both single and two-temperature systems. When used with a separate storage tank, the circulation may be either by gravity or by means of a circulating pump. When a circulating pump is used it is important to note that the flow rate should be slow so that there will be a minimum of turbulence inside the heater.

If a water heater is installed in a closed water system, contact the water supplier or local plumbing inspector on how to control this situation.

WATER (POTABLE) HEATING AND SPACE HEATING (See pages 17-23)

1. All piping components connected to this unit for space heating applications shall be suitable for use with potable water.

2. Toxic chemicals, such as those used for boiler treatment, shall NEVER be introduced into this system.

3. This unit may NEVER be connected to any existing heating system or component(s) previously used with a non-potable water heating appliance.

4. When the system requires water for space heating at temperatures higher than required for domestic water purposes, a tempering valve must be installed. Please refer to installation diagrams on pages 22 through 28 in back of manual for suggested piping arrangements.

CAUTION

A closed system will exist if a check valve (without bypass), pressure reducing valve (without bypass), or a water meter (without bypass) is installed in the cold water line between the water heater and street main (or well).

Excessive pressure may develop in such closed systems, causing premature tank failure or intermittent relief valve operation. This is not a warranty failure. An expansion tank or a similar device may be required in the inlet supply line between the appliance and the meter or valve to compensate for the thermal expansion of the water.

SYSTEM CONNECTIONS

The system installation must conform to these instructions and to the local code authority having jurisdiction. Good practice requires that all heavy piping be supported.

THERMOMETERS (Not Supplied)

Thermometers should be obtained and field installed as shown in the installation diagrams.

Thermometers are installed in the system as a means of detecting the temperature of the outlet water supply.

RELIEF VALVE

This water heater is equipped with a combination temperature-pressure relief valve that complies with the standard for relief valves and automatic gas shutoff devices for hot water supply system, ANSI Z21.22, for Canada see CAN/CSA 149.1 or.2. FOR SAFE OPERATION OF THE WATER HEATER, THE RELIEF VALVE(S) MUST NOT BE REMOVED OR PLUGGED.

ASME ratings cover pressure relief capacities. A.G.A. ratings cover release rate with temperature actuation.

In addition to the appliance relief valve, each remote storage tank which may be used in conjunction with this appliance shall also be installed with a properly sized, rated and approved combination temperature (ANSI) and pressure (ASME) relief valve(s).

WARNING

THE PURPOSE OF RELIEF VALVE IS TO AVOID EXCESSIVE PRESSURE OR TEMPERATURE INTO THE STEAM RANGE, WHICH MAY CAUSE SCALDING AT FIXTURES, TANK EXPLOSION, SYSTEM OR HEATER DAMAGE. NO VALVE IS TO BE PLACED BETWEEN THE RELIEF VALVE AND TANK.

Your local code authority may have other specific relief valve requirements.

A DRAIN LINE MUST BE CONNECTED TO THE RELIEF VALVE TO DIRECT DISCHARGE TO A SAFE LOCATION TO AVOID SCALDING OR WATER DAMAGE. THIS LINE MUST NOT BE REDUCED FROM THE SIZE OF THE VALVE OUTLET AND MUST NOT CONTAIN VALVES, RESTRICTIONS NOR SHOULD IT BE LOCATED IN FREEZING AREAS. DO NOT THREAD OR CAP THE END OF THIS LINE. RESTRICTED OR BLOCKED DISCHARGE WILL DEFEAT THE PURPOSE OF THE VALVE AND IS UNSAFE. DISCHARGE LINE SHALL BE INSTALLED TO ALLOW COMPLETE DRAINAGE OF BOTH THE VALVE AND LINE.

See SERVICE INFORMATION section for procedure and precautions.

GAS PIPING

Contact your local gas service company to ensure that adequate gas service is available and to review applicable installation codes for your area.

Size the main gas line in accordance with Table III. (See last page in manual). The figures shown are for straight lengths of pipe at 0.5 in. W.C. pressure drop, which is considered normal for low pressure systems. Note: Fittings such as elbows, tees and line regulators will add to the pipe pressure drop. Also refer to the latest version of the National Fuel Gas Code. For Canadian installations consult Canadian Installation Code CAN/CGA B149.1 or .2.

TABLE lll - GAS SUPPLY LINE SIZES (IN INCHES)*
MAXIMUM CAPACITY OF PIPE IN
CUBIC FEET PER HOUR

LENGTH IN FEET	NOMINAL IRON PIPE SIZES (INCHES)								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
10	175	360	680	1400	2100	3960	6300	11000	23000
20	120	250	465	950	1460	2750	4360	7700	15800
30	97	200	375	770	1180	2200	3520	6250	12800
40	82	170	320	660	990	1900	3000	5300	10900
50	73	151	285	580	900	1680	2650	4750	9700
60	66	138	260	530	810	1520	2400	4300	8800
70	61	125	240	490	750	1400	2250	3900	8100
80	57	118	220	460	690	1300	2050	3700	7500
90	53	110	205	430	650	1220	1950	3450	7200
100	50	103	195	400	620	1150	1850	3250	6700
125	44	93	175	360	550	1020	1650	2950	6000
150	40	84	160	325	500	950	1500	2650	5500
175	37	77	145	300	460	850	1370	2450	5000
200	35	72	135	280	430	800	1280	2280	4600

⚠ WARNING

THE HEATER IS NOT INTENDED FOR OPERATION AT HIGHER THAN 14.0" W.C.(3.48 Kpa) - NATURAL GAS, 14.0" W.C. (3.48 Kpa) - PROPANE GAS (1/2 POUND PER SQUARE INCH GAGE-3.45 Kpa) SUPPLY GAS PRESSURE. EXPOSURE TO HIGHER SUPPLY PRESSURE MAY CAUSE DAMAGE TO THE GAS VALVE WHICH COULD RESULT IN FIRE OR EXPLOSION. IF OVERPRESSURE HAS OCCURRED SUCH AS THROUGH IMPROPER TESTING OF GAS LINES OR EMERGENCY MALFUNCTION OF THE SUPPLY SYSTEM, THE GAS VALVE MUST BE CHECKED FOR SAFE OPERATION. MAKE SURE THAT THE OUTSIDE VENTS ON THE SUPPLY REGULATORS AND THE SAFETY VENT VALVES ARE PROTECTED AGAINST BLOCKAGE. THESE ARE PARTS OF THE GAS SUPPLY SYSTEM, NOT THE HEATER. VENT BLOCKAGE MAY OCCUR DURING ICE STORMS.

IT IS IMPORTANT TO GUARD AGAINST GAS VALVE FOULING FROM CONTAMINANTS IN THE GAS WAYS. SUCH FOULING MAY CAUSE IMPROPER OPERATION, FIRE OR EXPLOSION.

IF COPPER SUPPLY LINES ARE USED THEY MUST BE INTERNALLY TINNED AND CERTIFIED FOR GAS SERVICE. BEFORE ATTACHING THE GAS LINE, BE SURE THAT ALL GAS PIPE IS CLEAN ON THE INSIDE.

TO TRAP ANY DIRT OR FOREIGN MATERIAL IN THE GAS SUPPLY LINE, A DIRT LEG (SOMETIMES CALLED SEDIMENT TRAP OR DRIP LEG) MUST BE INCORPORATED IN THE PIPING (SEE FIG. 10). THE DIRT LEG MUST BE READILY ACCESSIBLE AND NOT SUBJECT TO FREEZING CONDITIONS. INSTALL IN ACCORDANCE WITH RECOMMENDATIONS OF SERVING GAS SUPPLIERS. REFER TO THE LATEST VERSION OF THE NATIONAL FUEL GAS CODE. For Canadian installations consult Canadian Installation Code CAN/CGA B149.1 or .2.

To prevent damage, care must be taken not to apply too much torque when attaching gas supply pipe to gas valve inlet.

Apply joint compounds (pipe dope) sparingly and only to the male threads of pipe joints. Do not apply compounds to the first two threads. Use compounds resistant to the action of liquefied petroleum gases.

GAS PIPING AND DIRT LEG INSTALLATION

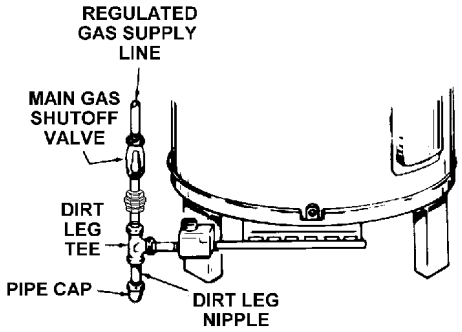


FIGURE 10

BEFORE PLACING THE HEATER IN OPERATION, CHECK FOR GAS LEAKAGE. Use soap and water solution or other material acceptable for the purpose in locating the leaks. DO NOT USE MATCHES, CANDLES, FLAME OR OTHER SOURCES OF IGNITION FOR THIS PURPOSE.

DISCONNECT THE HEATER AND ITS MANUAL GAS SHUTOFF VALVE FROM THE GAS SUPPLY PIPING SYSTEM DURING ANY SUPPLY PRESSURE TESTING EXCEEDING 1/2 PSIG (3.45 Kpa). GAS SUPPLY LINE MUST BE CAPPED WHEN DISCONNECTED FROM THE HEATER FOR TEST PRESSURES OF 1/2 PSIG (3.45 Kpa) OR LESS. THE APPLIANCE NEED NOT BE DISCONNECTED, BUT MUST BE ISOLATED FROM THE SUPPLY PRESSURE TEST BY CLOSING THE MANUAL GAS SHUTOFF VALVE.

PURGING

Gas line purging is required with new piping or systems in which air has entered.

⚠ CAUTION

PURGING SHOULD BE PERFORMED BY PERSONS EXPERIENCED IN THIS TYPE GAS SERVICE. TO AVOID RISK OF FIRE OR EXPLOSION, PURGE DISCHARGE MUST NOT ENTER CONFINED AREAS OR SPACES WHERE IGNITION CAN OCCUR. THE AREA MUST BE WELL VENTILATED AND ALL SOURCES OF IGNITION MUST BE INACTIVATED OR REMOVED.

GAS METER SIZE — NATURAL GASES ONLY

Be sure the gas meter has sufficient capacity to supply the full rated gas input of the water heater as well as the requirements of all other gas fired equipment supplied by the meter. If gas meter is too small, ask the gas company to install a larger meter having adequate capacity.

GAS PRESSURE REGULATOR

The gas pressure regulator is built into the gas valve and is equipped to operate on the gas specified on model and rating plate. The regulator is factory adjusted to deliver gas to burner at correct water column pressure allowing for a nominal pressure drop through the controls.

The minimum gas supply pressure for input adjustment must not be less than 4.5" w.c. (1.12 Kpa) for natural gas and 11.0" w.c. (2.74 Kpa) for propane gas.

Do not subject the combination gas valve to inlet gas pressures of more than 14.0" W.C. (3.48 Kpa) - natural gas, 14.0" W.C. (3.48 Kpa)- propane gas. A service regulator is necessary if higher gas pressures are encountered.
Gas pressure specified in Table IV, refer to flow pressure taken at pressure tap of automatic gas valve while heater is operating.

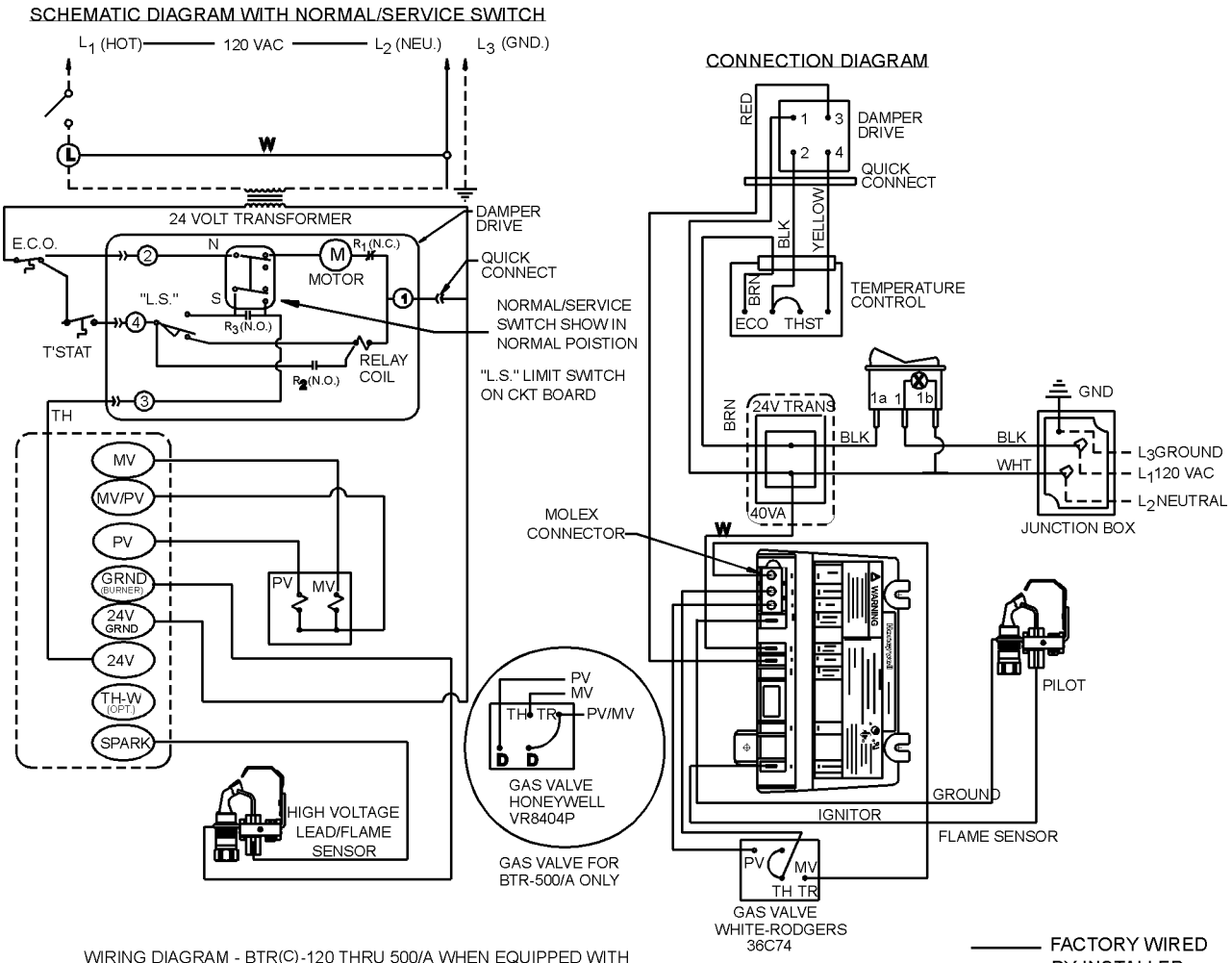
HEATER WIRING

All electrical work must be installed in accordance with the latest version of the National Electrical Code ANSI/NFPA No. 70, and / or the CSA C22.1 Electrical Code, for Canada use Canadian Electrical Code CSA C22.1 and must conform to all local code authority having jurisdiction. AN ELECTRICAL GROUND IS REQUIRED TO REDUCE RISK OF ELECTRICAL SHOCK OR POSSIBLE ELECTROCUTION.

For Canadian installations the electrical connections and grounding shall be done in accordance with current Canadian Electrical Code CSA C22.1, Part 1 and/or local codes.

If any of the original wire as supplied with the appliance must be replaced, use only type 105°C thermoplastic or equivalent. 250°C type F must be used for the flame sensor leads and the spark ignition cable must be high voltage 250°C.

SINGLE UNIT WIRING DIAGRAM BTR(C)-120 THROUGH BTR(C)-500A



WIRING DIAGRAM - BTR(C)-120 THRU 500/A WHEN EQUIPPED WITH A HONEYWELL IGNITION MODULE AND PILOT.
IF ANY OF THE ORIGINAL WIRE AS SUPPLIED MUST BE REPLACED, USE ONLY TYPE 105° C THERMOPLASTIC OR EQUIVALENT.
FLAME SENSOR IGNITION CABLE: MUST BE 250° C TYPE F

194174-000 REV. XX

FIGURE 11

INSTALLATION DIAGRAMS-TOP INLET/OUTLET USAGE

GENERAL

The type, size and location of the relief valves must be in accordance with local codes. The locations of the relief valves shown in the installation diagrams are typical. The heater has a factory installed high temperature limit switch and temperature and pressure relief valve.

Cold water lines to heater should be installed as shown in order to minimize gravity circulation of hot water to building cold water lines.

A listed temperature and pressure relief valve of adequate capacity is installed on the heater. The locations shown in the installation diagrams on the following pages are typical.

The discharge opening of the temperature and pressure relief valve, located in front of the heater must be piped to an open drain and should not be subject to freezing temperatures.

Install in accordance with all local codes.

Use of the top inlet water connection requires installation of an inlet dip tube (refer to figure 12). The tube is supplied in the heater. Follow caution labels if applying heat to this fitting. Do not allow pipe dope to contact the plastic tube during installation.

CODE RESTRICTIONS

Use of the top inlet water connection is not permitted on installations in the state of North Carolina, due to the material of the tube (Polypropylene). Where such code restrictions exist, use only lower inlet tank connection. This may also require a heat trap - check local codes. The “Top Outlet” connection may still be used on these applications. Plug or cap all unused openings in the tank before filling with water.

⚠DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

TUBE INLET INSTALLATION

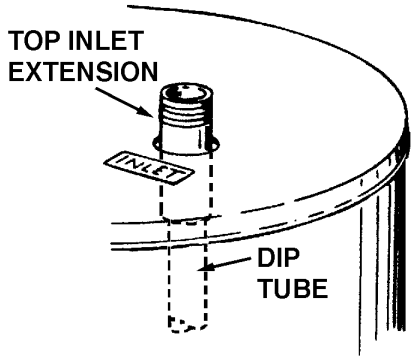
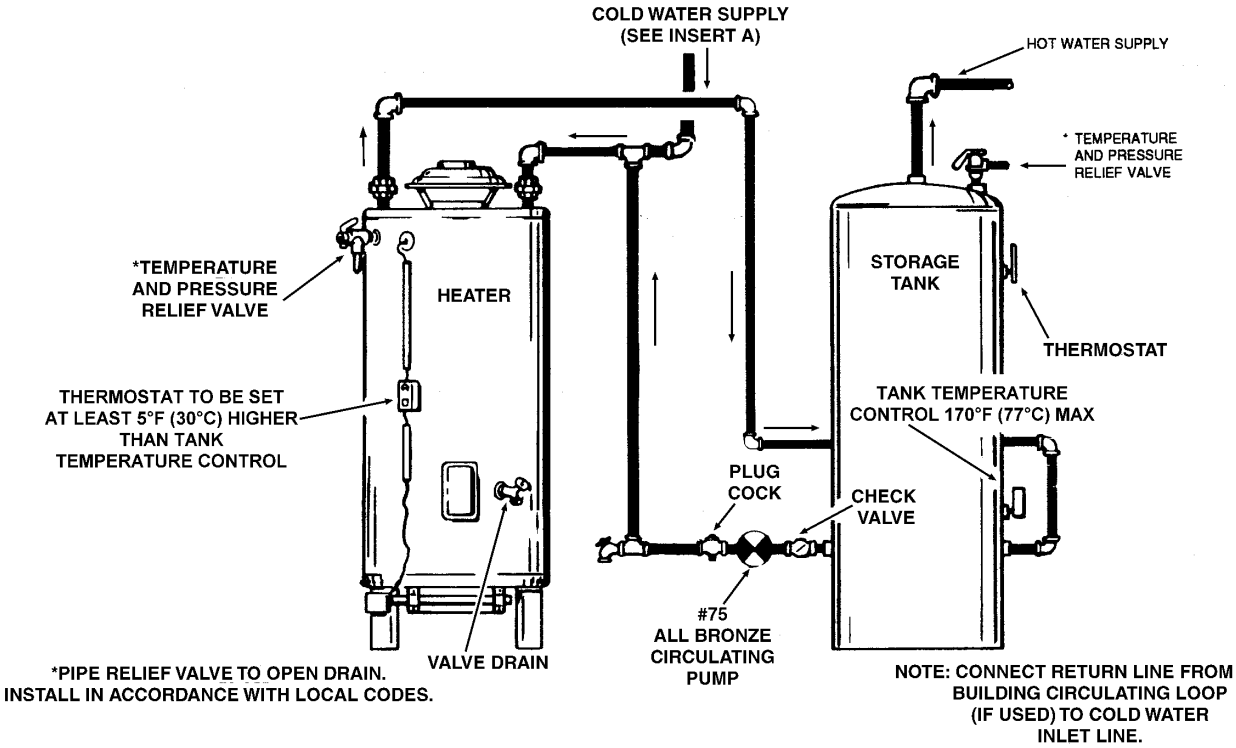


FIGURE 12

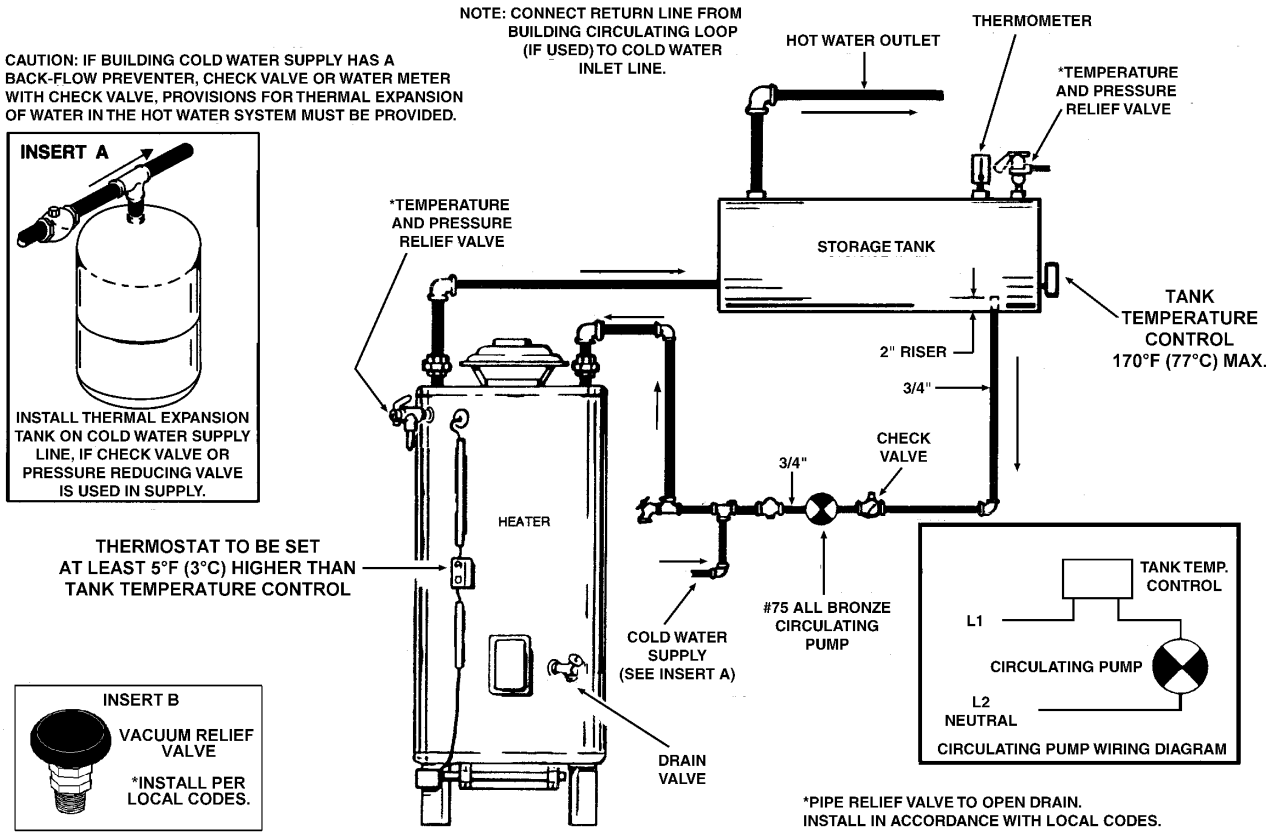
VERTICAL STORAGE TANK AND FORCED CIRCULATION


COLD WATER SUPPLY
(SEE INSERT A)
HOT WATER SUPPLY
* TEMPERATURE AND PRESSURE RELIEF VALVE
*TEMPERATURE AND PRESSURE RELIEF VALVE
HEATER
STORAGE TANK
THERMOSTAT
THERMOSTAT TO BE SET AT LEAST 5°F (30°C) HIGHER THAN TANK TEMPERATURE CONTROL
TANK TEMPERATURE CONTROL 170°F (77°C) MAX
PLUG COCK
CHECK VALVE
#75 ALL BRONZE CIRCULATING PUMP
VALVE DRAIN
*PIPE RELIEF VALVE TO OPEN DRAIN. INSTALL IN ACCORDANCE WITH LOCAL CODES.
NOTE: CONNECT RETURN LINE FROM BUILDING CIRCULATING LOOP (IF USED) TO COLD WATER INLET LINE.

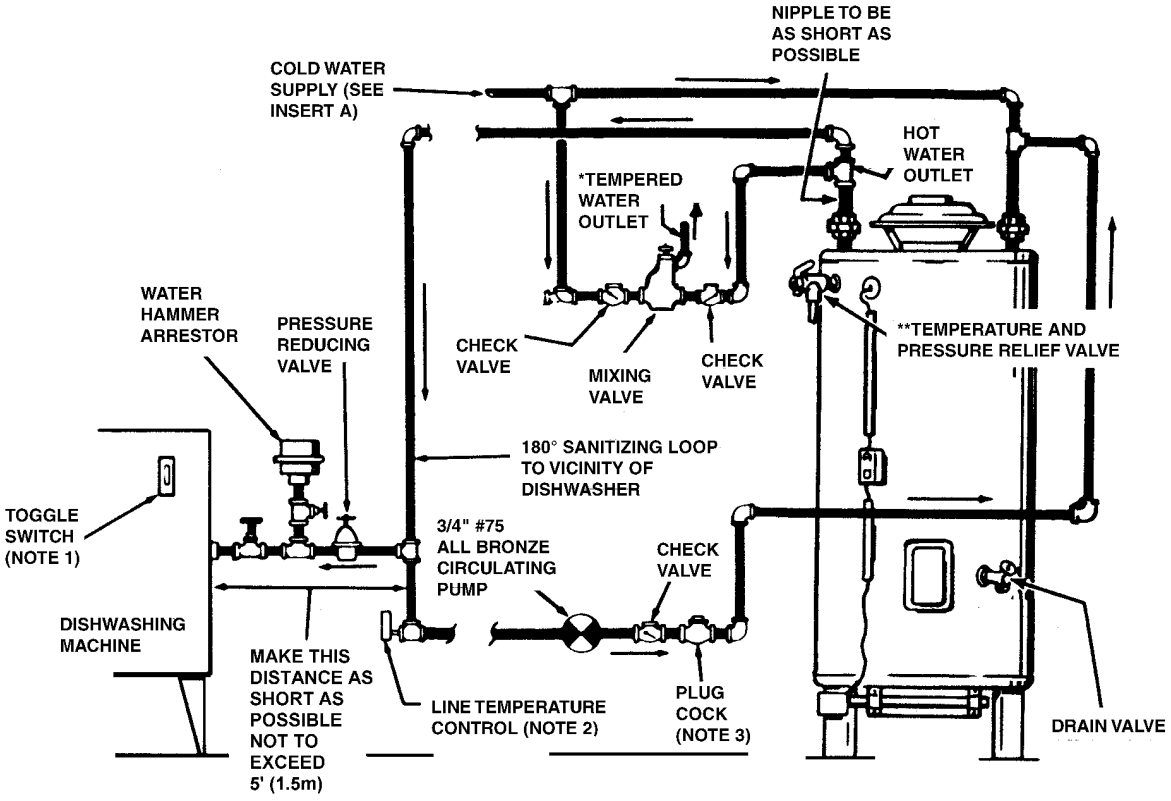
DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

HORIZONTAL STORAGE TANK AND FORCED CIRCULATION


NOTE: CONNECT RETURN LINE FROM BUILDING CIRCULATING LOOP (IF USED) TO COLD WATER INLET LINE.
CAUTION: IF BUILDING COLD WATER SUPPLY HAS A BACK-FLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.
HOT WATER OUTLET
THERMOMETER
*TEMPERATURE AND PRESSURE RELIEF VALVE
INSERT A
INSTALL THERMAL EXPANSION TANK ON COLD WATER SUPPLY LINE, IF CHECK VALVE OR PRESSURE REDUCING VALVE IS USED IN SUPPLY.
*TEMPERATURE AND PRESSURE RELIEF VALVE
STORAGE TANK
TANK TEMPERATURE CONTROL 170°F (77°C) MAX.
2" RISER
3/4"
CHECK VALVE
3/4"
HEATER
THERMOSTAT TO BE SET AT LEAST 5°F (3°C) HIGHER THAN TANK TEMPERATURE CONTROL
#75 ALL BRONZE CIRCULATING PUMP
COLD WATER SUPPLY (SEE INSERT A)
TANK TEMP. CONTROL
L1
CIRCULATING PUMP
L2 NEUTRAL
CIRCULATING PUMP WIRING DIAGRAM
INSERT B
VACUUM RELIEF VALVE
*INSTALL PER LOCAL CODES.
DRAIN VALVE
*PIPE RELIEF VALVE TO OPEN DRAIN. INSTALL IN ACCORDANCE WITH LOCAL CODES.

TWO TEMPERATURE - ONE HEATER HIGH TEMPERATURE STORAGE WITH RECIRCULATION OF SANITIZING LOOP


NIPPLE TO BE AS SHORT AS POSSIBLE
COLD WATER SUPPLY (SEE INSERT A)
HOT WATER OUTLET
*TEMPERED WATER OUTLET
WATER HAMMER ARRESTOR
PRESSURE REDUCING VALVE
CHECK VALVE
MIXING VALVE
CHECK VALVE
**TEMPERATURE AND PRESSURE RELIEF VALVE
180° SANITIZING LOOP TO VICINITY OF DISHWASHER
TOGGLE SWITCH (NOTE 1)
3/4" #75 ALL BRONZE CIRCULATING PUMP
CHECK VALVE
DISHWASHING MACHINE
MAKE THIS DISTANCE AS SHORT AS POSSIBLE NOT TO EXCEED 5' (1.5m)
LINE TEMPERATURE CONTROL (NOTE 2)
PLUG COCK (NOTE 3)
DRAIN VALVE

NOTE 1: TOGGLE SWITCH CONTROLS 180°F (82°C) WATER CIRCULATION. INSTALL ON OR CLOSE TO DISHWASHING MACHINE. TOGGLE SWITCH MUST BE CLOSED (ON) DURING THE RINSE OPERATION AND OPEN (OFF) WHEN DISHWASHER IS NOT OPERATING OR WHEN ON LONG STANDBY.

NOTE 2: INSTALL LINE TEMPERATURE CONTROL IN AN UNINSULATED TEE BEYOND THE DISHWASHING MACHINE TAKEOFF IN THE SANITIZING LOOP. CONTROL SHOULD BE SET AT 185°F (85°C).

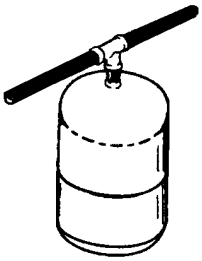
NOTE 3: ADJUST PLUG COCK SO THE SANITIZING LOOP FLOW RATE DOES NOT CAUSE UNNECESSARY TURBULENCE IN THE TANK.

* TEMPERED WATER LOOP, IF USED, CONNECT TO POINT "A".
**PIPE RELIEF VALVE TO OPEN DRAIN. INSTALL IN ACCORDANCE WITH LOCAL CODES.

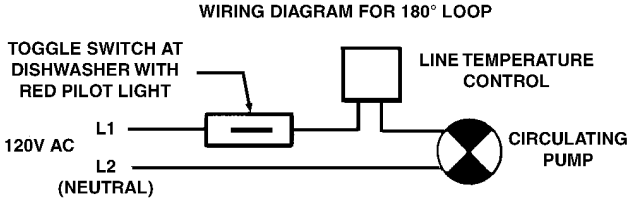
CAUTION: IF BUILDING COLD WATER SUPPLY HAS A BACKFLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE. PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

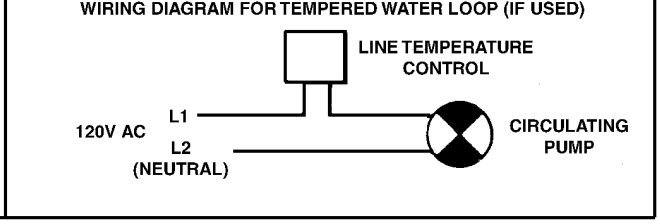
⚠DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 30. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.



INSTALL THERMAL EXPANSION TANK IF CHECK VALVE OR PRESSURE REDUCING VALVE IS USED IN SUPPLY



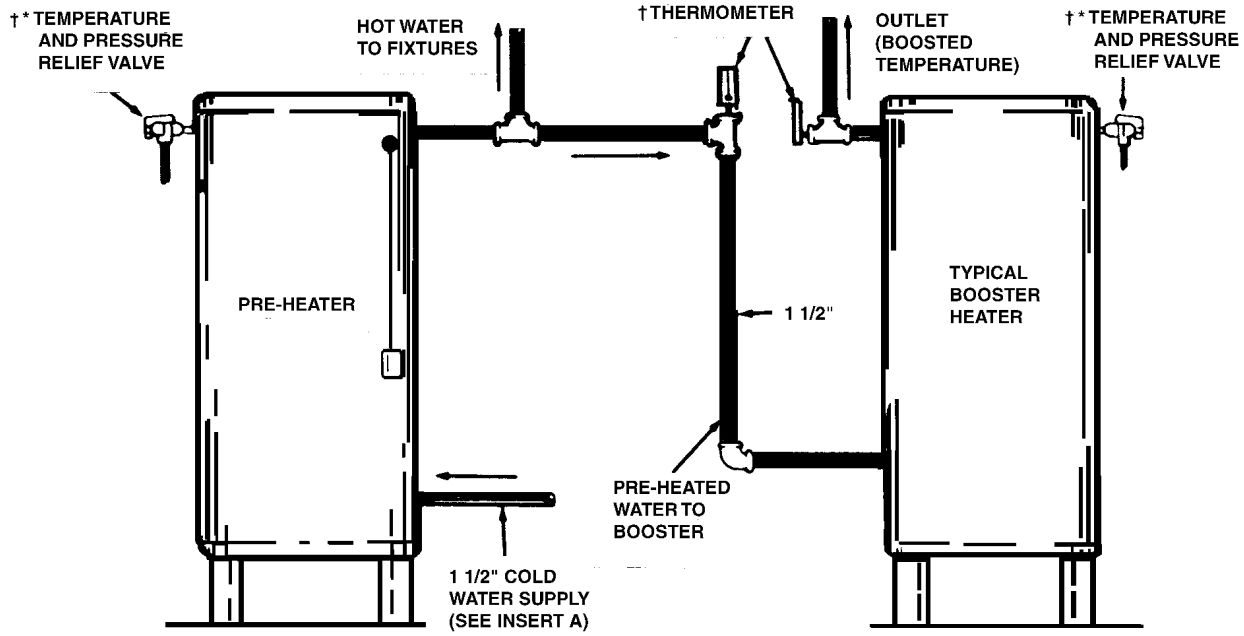


INSTALLATION DIAGRAMS-SIDE INLET/OUTLET USAGE

A listed temperature and pressure relief valve of adequate capacity is installed on the heater. The locations shown in the installation diagrams on the following pages are typical.

The discharge opening of the temperature and pressure relief valve must be piped to an open drain and should not be subject to freezing conditions. DO NOT REDUCE, BLOCK OR PLUG THE DISCHARGE OPENING OF THE VALVE.

TWO TEMPERATURE - TWO HEATERS, ONE PRE-HEATER/ONE - BOOSTER HEATER WITH OR WITHOUT BUILDING RECIRCULATION



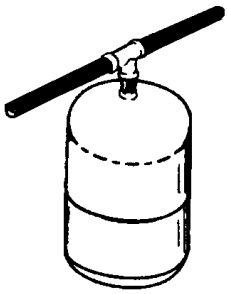
⚠DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

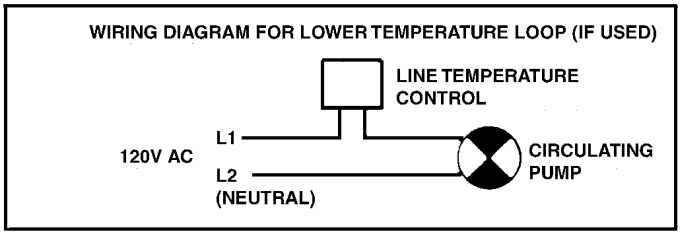
CIRCULATING RETURN LINE CONNECTIONS

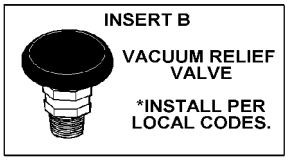
– FROM FIXTURE LOOP, IF USED, CONNECT TO PRE-HEATER INLET.
– FROM BOOSTED TEMPERATURE LOOP, IF USED CONNECT TO BOOSTER INLET.
† AVAILABLE FROM A. O. SMITH.
* PIPE RELIEF VALVE TO OPEN DRAIN.

INSTALL IN ACCORDANCE WITH LOCAL CODES.



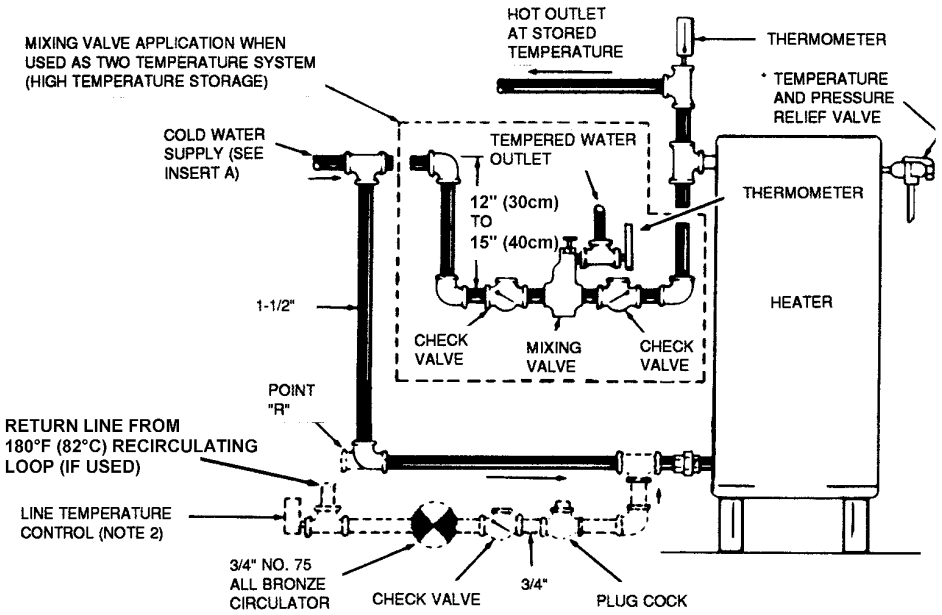
INSTALL THERMAL EXPANSION TANK IF CHECK VALVE OR PRESSURE REDUCING VALVE IS USED IN SUPPLY





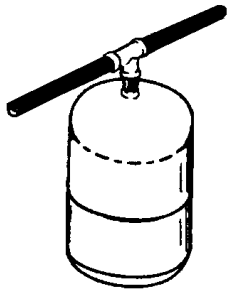
ONE OR TWO TEMPERATURE - ONE HEATERS,HIGH TEMPERATURE STORAGE WITH OR WITHOUT RECIRCULATION

HEATER WITH OR WITHOUT MIXING VALVE



DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.



INSTALL THERMAL EXPANSION TANK IF CHECK VALVE OR PRESSURE REDUCING VALVE IS USED IN SUPPLY

HEATER WITH MIXING VALVE AND RECIRCULATED SANITIZING LOOP

* PIPE RELIEF VALVE TO OPEN DRAIN.

INSTALL IN ACCORDANCE WITH LOCAL CODES.

CIRCULATING RETURN LINE CONNECTIONS.

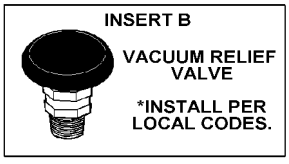
- TEMPERED WATER LOOP, IF USED, CONNECT TO POINT "R".

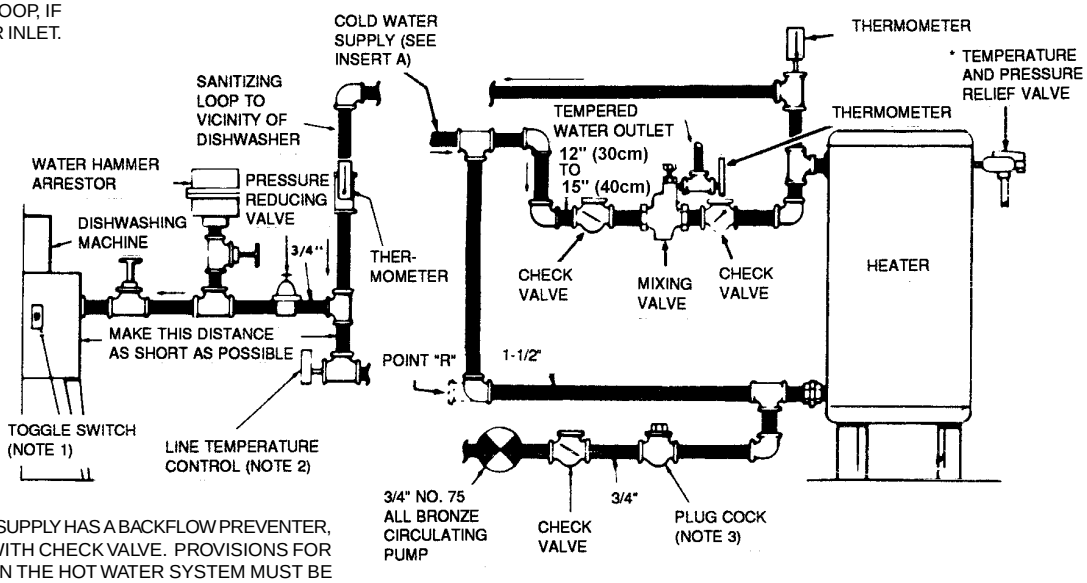
- STORED TEMPERATURE WATER LOOP, IF USED, CONNECT TO COLD WATER INLET.

NOTE 1: TOGGLE SWITCH CONTROLS 180°F (82°C) WATER CIRCULATION. INSTALL ON OR CLOSE TO DISHWASHING MACHINE. TOGGLE SWITCH MUST BE CLOSED (ON) DURING THE RINSE OPERATION AND OPEN (OFF) WHEN DISHWASHER IS NOT OPERATING OR WHEN ON LONG STANDBY.

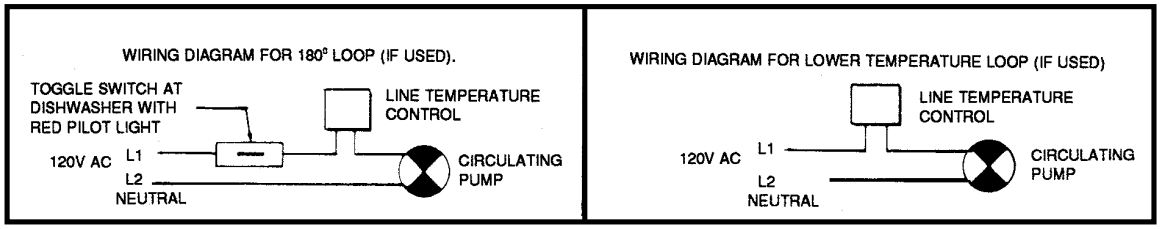
NOTE 2: INSTALL LINE TEMPERATURE CONTROL IN AN UNINSULATED TEE BEYOND THE DISHWASHING MACHINE TAKEOFF IN THE SANITIZING LOOP. CONTROL SHOULD BE SET AT 185°F (85°C).

NOTE 3: ADJUST PLUG COCK SO THE SANITIZING LOOP FLOW RATE DOES NOT CAUSE UNNECESSARY TURBULENCE IN THE TANK.



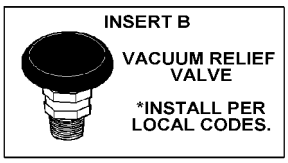


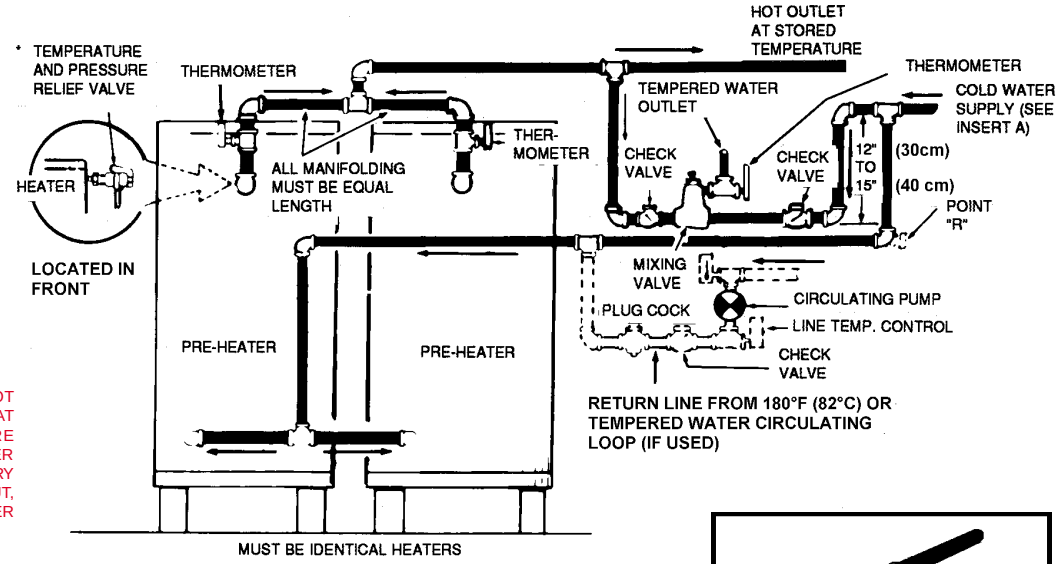
CAUTION: IF BUILDING COLD WATER SUPPLY HAS A BACKFLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE. PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.



TWO TEMPERATURE - TWO PRE-HEATERS WITH MIXING VALVE OR BOOSTER HEATER WITH OR WITHOUT BUILING RECIRCULATION

TWO PRE-HEATERS WITH MIXING VALVE

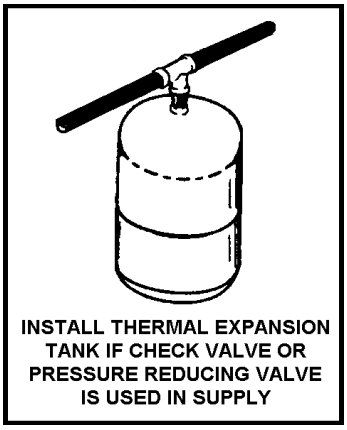




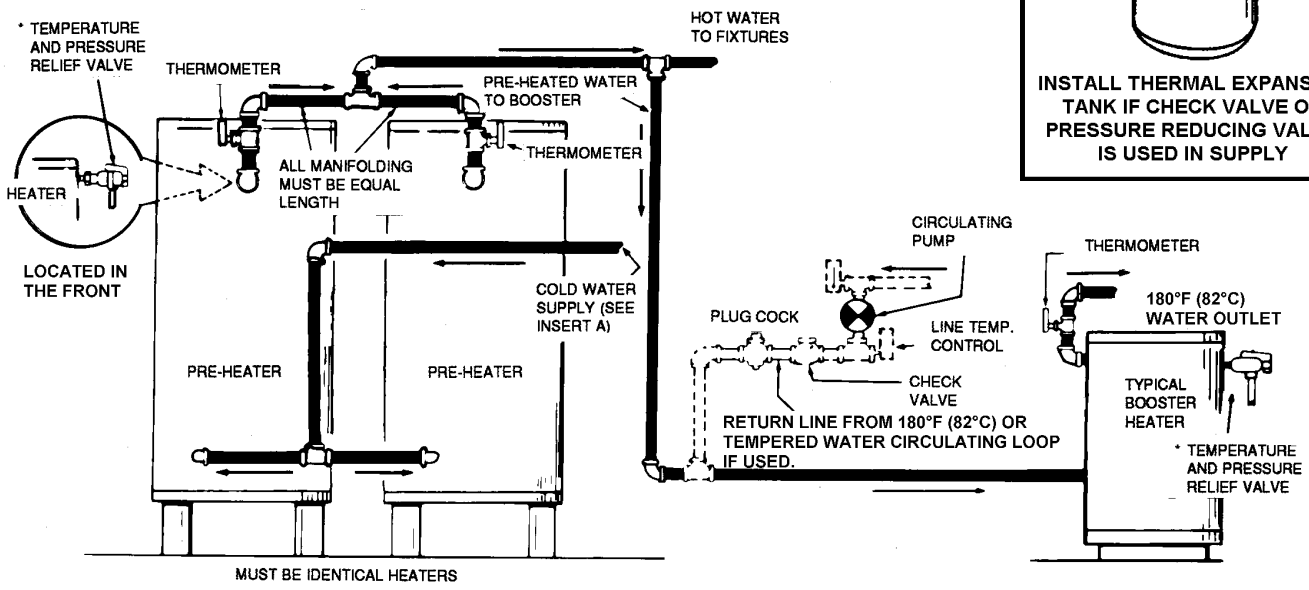
⚠ DANGER

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

CIRCULATING RETURN CONNECTIONS
TEMPERED WATER LOOP, IF USED, CONNECT TO POINT "R"



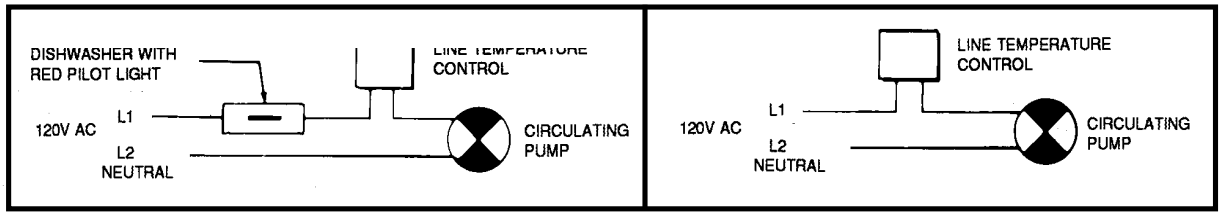
TWO PRE-HEATERS WITH BOOSTER HEATER



CAUTION: IF BUILDING COLD WATER SUPPLY HAS A BACKFLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

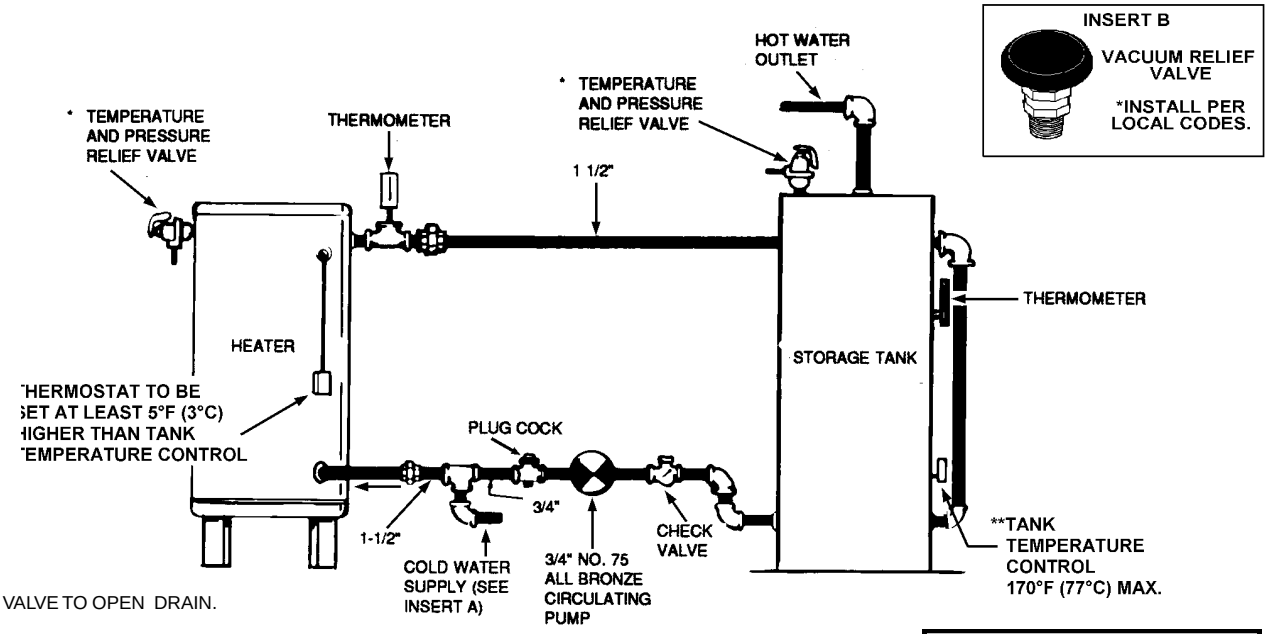
* PIPE RELIEF VALVE TO OPEN DRAIN.
INSTALL IN ACCORDANCE WITH LOCAL CODES.

CIRCULATING RETURN LINE CONNECTIONS.
-- FOR PRE-HEATED WATER LOOP, IF USED, CONNECT TO COLD WATER INLET OR PRE-HEATERS.



MEDIUM TEMPERATURE - ONE HEATER WITH AUXILIARY STORAGE TANK FORCED CIRCULATION WITH OR WITHOUT BUILDING RECIRCULATION

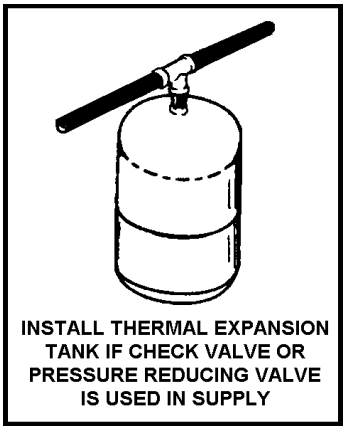
VERTICAL STORAGE TANK



* PIPE RELIEF VALVE TO OPEN DRAIN.

**WHEN USING AN A.O. SMITH T-140, -200, -350 OR -400 STORAGE TANK, USE LOWER 3/4" OPENING FOR TANK TEMPERATURE CONTROL.

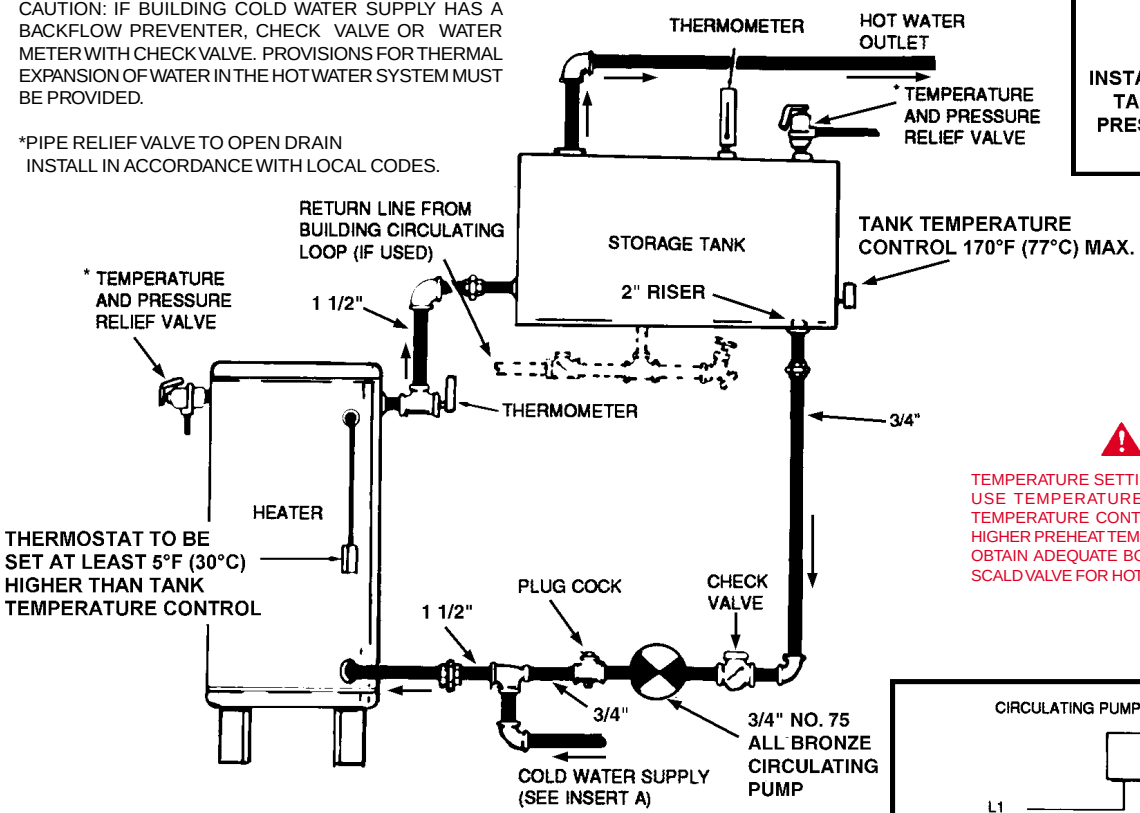
IF BUILDING CIRCULATING LOOP IS USED, CONNECT TO AN OPENING NEAR THE BOTTOM OF THE TANK.



HORIZONTAL STORAGE TANK

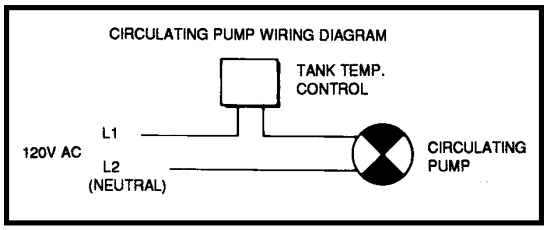
CAUTION: IF BUILDING COLD WATER SUPPLY HAS A BACKFLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE. PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

*PIPE RELIEF VALVE TO OPEN DRAIN
INSTALL IN ACCORDANCE WITH LOCAL CODES.



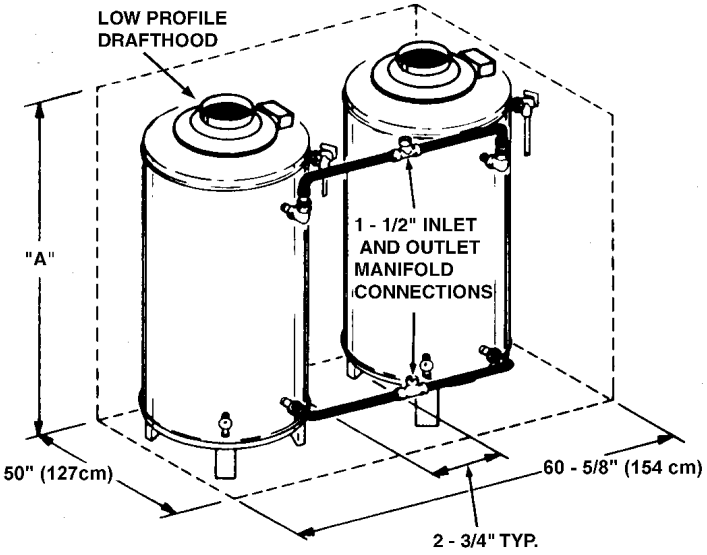
DANGER

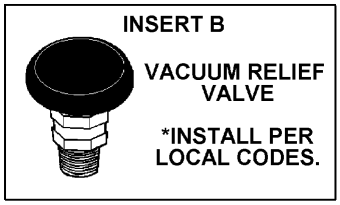
TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL WARNING ON PAGE 29. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.



MANIFOLD KITS

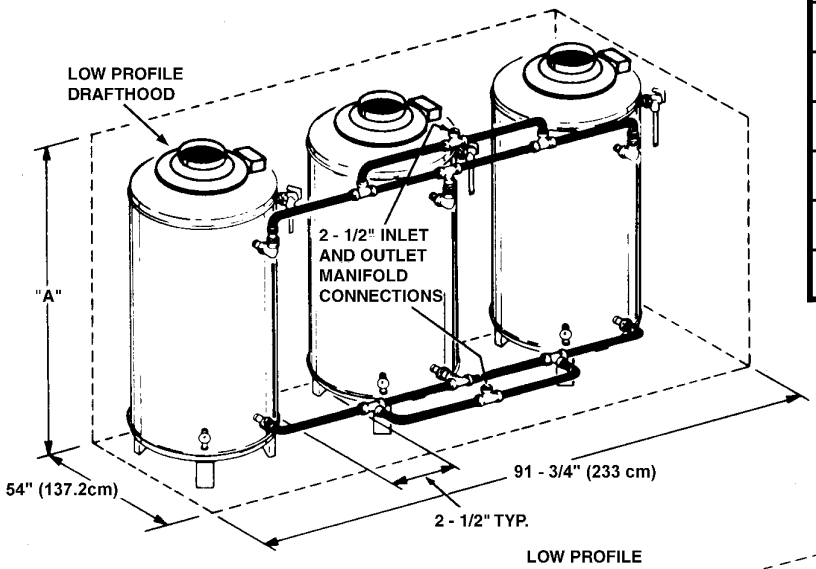
TWO UNIT MANIFOLD KIT (PART NO. 78692)



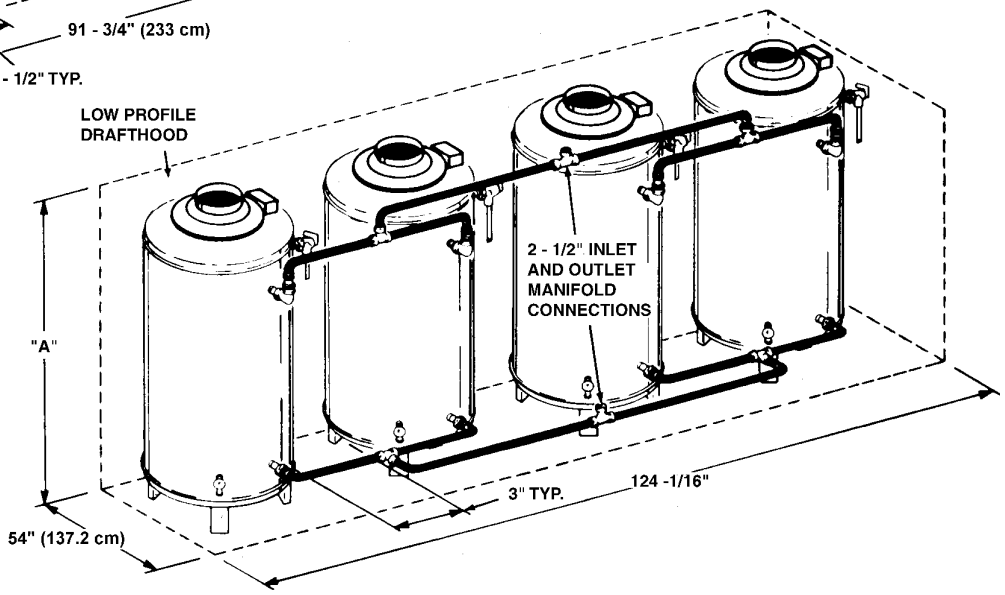


MODEL	DIMENSIONS "A" INCHES (CM)	
	LOW PROFILE VERTICAL HOOD "A"	
	BTR MODELS	BTRC MODELS
120	69.75" (177 cm)	69.75" (177 cm)
154	73.00" (185 cm)	73.00" (185 cm)
180	67.50" (171 cm)	70.50" (179 cm)
197	75.00 (192 cm)	81.50" (207 cm)
198	75.00 (192 cm)	N/A
199	67.50" (171 cm)	70.50" (179 cm)
200	72.00" (183 cm)	72.00" (183 cm)
250	72.00" (183 cm)	72.00" (183 cm)
251	75.00" (191 cm)	75.00" (191 cm)
275	72.00" (183 cm)	72.00" (183 cm)
305	75.00" (191 cm)	75.00" (191 cm)
365	79.50" (202 cm)	75.00" (191 cm)
400	75.50" (192 cm)	75.50" (192 cm)
500	82.25" (209 cm)	82.25" (209 cm)

THREE UNIT MANIFOLD KIT (PART NO. 78593)



FOUR UNIT MANIFOLD KIT (PART NO. 78694)



MECHANICAL VENTING

SINGLE UNIT INSTALLATION

When mechanical venting of these heaters is desired, the following kits are available.

BTR(C) 120 through the BTR(C) 200/A
A. O. Smith part number 193933

BTR(C) 250/A through the BTR(C) 500/A
A. O. Smith part number 193933-1

Where an approved poweer venter is to be installed to operate in conjunction with the water heater thermostat, the following codes must be adhered to. Field wiring should conform to the latest version of the National Electric Code ANSI/NFPA No. 70. For Canadian installations the electrical connections and grounding shall be done in accordance with the current Canadian Electrical Code CSA C22.1 Part 1 and/or local codes.

NOTE: The power venter must be installed downstream of the drafthood. See figure 13.

- Install power venter in the vent system.
- Take one way plugs and insert male into thermostat connector and plug female into connection coming from drafthood.
- Run 120 VAC to power venter.

See side wall vent kit installation manual for complete instructions.

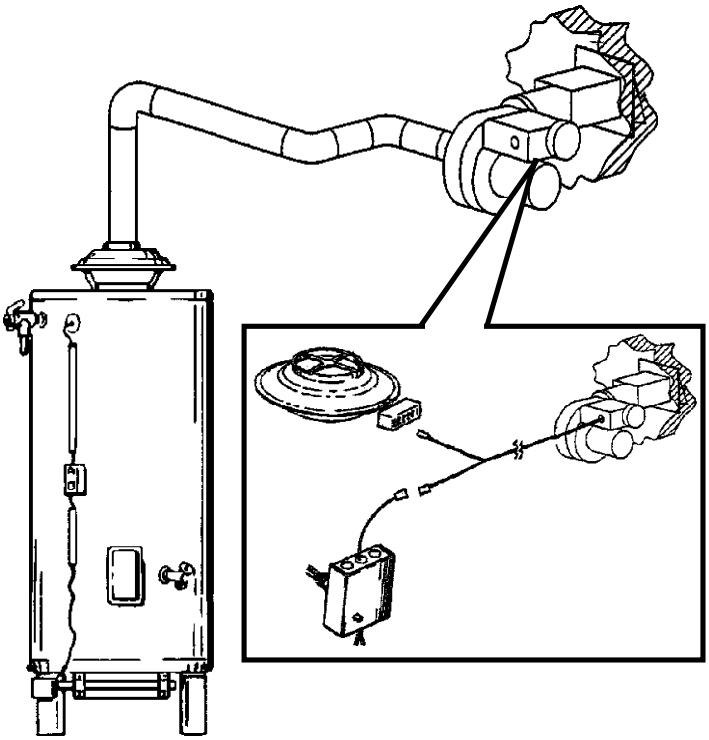


FIGURE 13

VENT INSTALLATION

Seal all joints between the power venter and the vent termination. This is to prevent leakage of exhaust products into the room(s) due to positive pressure of blower.

The "Sequence of Operation" description will be the same with mechanical venting except,

When the appliance thermostat calls for heat:

Thermostat contacts "Close" and the power venter blower (120 VAC) is energized. Sufficient draft must be established for the "Draft Prover Switch (N.O.)" to "Close". When the draft prover switch "Closes" the relay coil of the flue damper is energized.

See side wall vent kit installation manual for complete instructions.

MULTIPLE UNIT INSTALLATIONS

For multiple unit installations, contact A.O. Smith Water Products Company, Technical Support Center at 1-800-527-1953. In Canada, contact A.O. Smith Enterprises, Ltd. at 1-800-265-8520.

TABLE IV
MANIFOLD GAS PRESSURE IN INCHES OF WATER COLUMN (ALL MODELS*)

TYPE OF GAS	
Natural	**Propane**
3.5	10.0

Gas pressure specified in Table lV, refer to flow pressure taken at pressure tap of automatic gas valve while heater is operating.

TABLE V
APPROXIMATE TIME REQUIRED TO CONSUME 1 CU. FT. OF GAS AT FULL CAPACITY

INPUT RATE (BTUH)	TYPE OF GAS	BTUH PER CU. FT.	TIME REQ'D TO CONSUME 1 CU. FT. OF GAS
120,000	NATURAL PROPANE	1050 2500	31.5 SEC. 75.0 SEC.
154,000	NATURAL PROPANE	1050 2500	24.5 SEC. 58.4 SEC.
180,000	NATURAL PROPANE	1050 2500	21.1 SEC. 50.3 SEC.
190,000	NATURAL PROPANE	1050 2500	19.9 SEC. 47.4 SEC.
199,000	NATURAL PROPANE	1050 2500	19.0 SEC. 47.4 SEC.
250,000	NATURAL PROPANE	1050 2500	15.1 SEC. 35.3 SEC.
251,000	NATURAL PROPANE	1050 2500	15.06 SEC. 35.1 SEC.
275,000	NATURAL PROPANE	1050 2500	13.75 SEC. 32.2 SEC.
305,000	NATURAL PROPANE	1050 2500	12.4 SEC. 29.5 SEC.
360.000	NATURAL PROPANE	1050 2500	11.4 SEC. 24.0 SEC.
365,000	NATURAL PROPANE	1050 2500	10.4 SEC. 24.7 SEC.
399,000	NATURAL PROPANE	1050 2500	9.5 SEC. 22.6 SEC.
500,000	NATURAL PROPANE	1050 2500	7.6 SEC. 18.0 SEC.

Figures shown are valid for 0-2000 ft. installations. See “HIGH ALTITUDE INSTALLATIONS” for deration requirements over 2000 ft.

TABLE VII
PILOT BURNER INFORMATION

MODEL	TYPE OF GAS	PILOT BURNER PART NUMBER (WITH ORIFICE)	RATED ORIFICE SIZE
All Models*	Natural	193314-0	0.018
	Propane	193314-1	0.014

OPERATION

IMPORTANT

A qualified person must perform the initial firing of the heater. At this time the user should not hesitate to ask the individual any questions which they may have in regard to the operation and maintenance of the unit.

An Operational Checklist is included at the rear of this manual. By using this checklist the user may be able to make minor operational adjustments and avoid unnecessary service calls. However, the user should not attempt repairs which are not listed under the USER column.

GENERAL

NEVER OPERATE THE HEATER WITHOUT FIRST BEING CERTAIN IT IS FILLED WITH WATER AND A TEMPERATURE AND PRESSURE RELIEF VALVE IS INSTALLED IN THE RELIEF VALVE OPENING OF THE HEATER.

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS CONTROL VALVE TO THE APPLIANCE.

⚠ CAUTION

Before proceeding with the operation of the unit make sure the water heater and system are filled with water and all air is expelled.

FILLING

1. Close the heater drain valve by turning handle clockwise.
2. Open a nearby hot water faucet to permit the air in the system to escape.
3. Fully open the cold water inlet pipe valve allowing the heater and piping to be filled.
4. Close the hot water faucet as water starts to flow.
5. The heater is ready to be operated.

⚠ WARNING

THE GAS VALVE MUST HAVE BEEN IN THE OFF POSITION FOR AT LEAST 5 MINUTES. This waiting period is an important safety step. Its purpose is to permit gas that may have accumulated in the combustion chamber to clear. IF YOU DETECT GAS ODOR AT THE END OF THIS PERIOD DO NOT PROCEED WITH LIGHTING. RECOGNIZE THAT GAS EVEN IF IT SEEMS WEAK, MAY INDICATE PRESENCE OF ACCUMULATED GAS SOMEPLACE IN THE AREA WITH RISK OF FIRE OR EXPLOSION. SEE THE FRONT PAGE FOR STEPS TO BE TAKEN.

All gas and water lines leak tested and open.

Read SEQUENCE OF OPERATION section of this manual prior to lighting and operating this appliance.

With above conditions satisfied, light the unit in accordance with the instructions on the Operating label attached to the heater. If label instructions are not legible - determine which gas valve the appliance is equipped with and use the applicable OPERATING INSTRUCTIONS as follows:

IF PILOT FLAME GOES OUT - Main burners will extinguish and pilot will attempt reignition.

DAMPER MUST BE IN FULL OPEN POSITION FOR PILOT AND/OR MAIN BURNER IGNITION TO OCCUR - See SEQUENCE OF OPERATION for complete description.

Each heater is equipped with a Honeywell Ignition Module. This module will try to prove pilot for 90 seconds. If pilot is not proven within the 90 secs, the unit will retry after 5 minutes. This cycle will continue until pilot is proven.

If pilot does not ignite when system calls for heat, check for pilot ignition spark at pilot assembly. Refer to OPERATIONAL CHECKLIST and SEQUENCE OF OPERATION.

ADJUSTMENTS

ON INITIAL STARTUP SOME ADJUSTMENTS ARE NECESSARY.

1. CHECK MANIFOLD AND INLET GAS PRESSURES.
2. TO ADJUST PILOT FLAME - FOLLOW "PILOT BURNER" PROCEDURE UNDER "SERVICE INFORMATION" SECTION.
3. DAMPER OPERATION CHECK - CHECK AT LEAST ONE COMPLETE BURNER OPERATION - WHEN THERMOSTAT IS SATISFIED - BURNERS WILL SHUT OFF AND DAMPER WILL AUTOMATICALLY "CLOSE". ON CALL FOR HEAT - THE DAMPER WILL AUTOMATICALLY "OPEN" AND THE IGNITION SEQUENCE DESCRIBED ABOVE WILL BEGIN. SEE "SEQUENCE OF OPERATION".

SEQUENCE OF OPERATION

The following information will describe the Sequence of Operation for this appliance.

A. ELECTRICAL POWER "OFF":

In the case of 1) initial installation, 2) maintenance or service shutdown, or 3) a "power failure" condition: the flue damper will be in the "open" position (parallel to the direction of flow of flue gas). The flue damper device is equipped with a springwound mechanism which springs "open" in a de-energized condition. Follow "Lighting and Operating" instructions on the appliance for start-up procedure.

For purpose of definition in this section and throughout manual the term:

A. Flue Damper "Open" - refers to the position of the flue damper blade when the blade is "parallel" to the normal direction of

the flow of flue gases through the draft hood during normal operation.

B. Flue Damper "Closed" - refers to the position of the flue damper blade when the blade is "perpendicular" relative to the normal direction of the flow of flue gases through the draft hood during normal operation.

"A" DAMPER "OPEN"

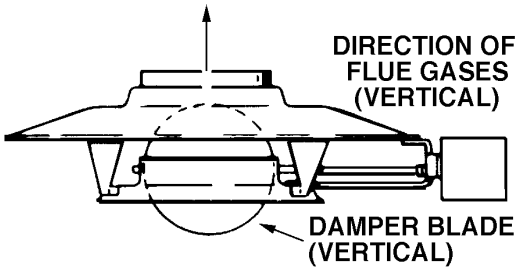


FIGURE 15

"B" DAMPER "CLOSED"

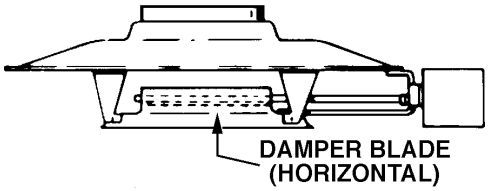


FIGURE 16

APPLIANCE IN "STANDBY CONDITION/NO CALL FOR HEAT DAMPER CLOSED"

— The motor is energized during appliance thermostat "off" cycles. The flue damper is in the "closed" position and the flue damper electrical circuit noted (fig. 17) is in effect.

-- HEATER IS OFF WITH THERMOSTAT OPEN, DAMPER MOTOR ENERGIZED AND DAMPER CLOSED.

DAMPER MOTOR DRIVE CIRCUIT BOARD

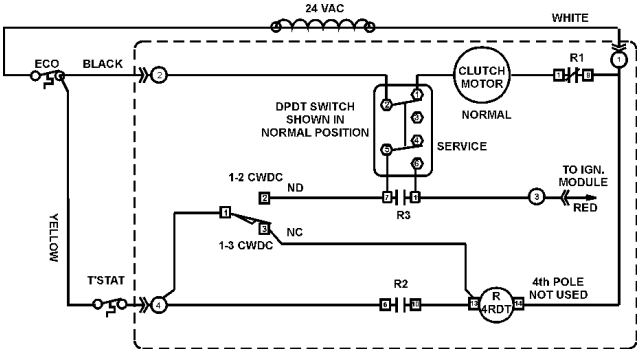


FIGURE 17

ON APPLIANCE "CALL FOR HEAT"

— Thermostat contacts "close" and relay coil is energized. Relay opens R1 which de-energizes damper motor, allowing damper to open. The open damper switches S1, with R2 and R3 now closed, the electrical circuit energizes the ignition system allowing the gas valve to operate.

— The flue damper spring begins to operate to return the damper blade to the "open" position to permit operation of the appliance.

DAMPER MOTOR DRIVE CIRCUIT BOARD

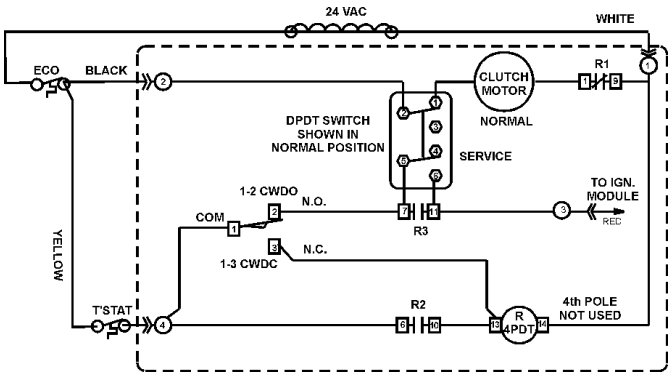


FIGURE 18

NOTE: If the flue damper does not follow the description above, it may be defective or otherwise damaged. Also, see "Trouble-Shooting" and "Operational Checklist".

APPLIANCE OPERATION

NOTE: The flue damper must be in "OPEN" position when appliance pilot and/or main burners are operating.

With the above conditions satisfied the ignition sequence is initiated.

- Pilot spark ignitor is energized.
- Pilot gas valve "opens" and allows pilot gas to flow.
- Pilot gas will light from spark ignitor.
- Pilot ignition is proven by sensor.

Each heater is equipped with a Honeywell Ignition Module. This module will try to prove pilot for 90 seconds. If pilot is not proven within the 90 secs, the unit will retry after 5 minutes. This cycle will continue until pilot is proven.

- When pilot ignition is proven the spark stops and main gas valve opens allowing main burner gas to flow.

- "Proven" pilot ignites main burners. Main burners remain lit until thermostat contacts "open" (call for heat is satisfied).

HEATING CYCLE COMPLETED

Thermostat contacts "open". Main burner and pilot burner are extinguished.

— The flue damper relay coil is de-energized. Relay coil contacts (R_1) "close" and the flue damper motor is energized. Motor rotates slowly to position the damper blade in the "closed" position. The (R_2 and R_3) contacts "open".

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

FLAMMABLE

A. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE PILOT. DO NOT TRY TO LIGHT THE PILOT BY HAND.

B. BEFORE OPERATING SMELL ALL AROUND THE APPLIANCE AREA FOR GAS . BE SURE TO SMELL NEXT TO THE FLOOR BECAUSE SOME GAS IS HEAVIER THAN AIR AND WILL SETTLE ON THE FLOOR.

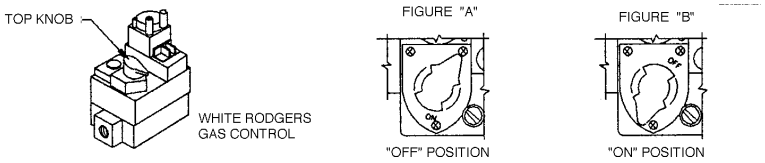
WHAT TO DO IF YOU SMELL GAS

- DO NOT TRY TO LIGHT ANY APPLIANCE.
- DO NOT TOUCH ANY ELECTRIC SWITCH DO NOT USE ANY PHONE IN YOUR BUILDING.
- IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

C. USE ONLY YOUR HAND TO PUSH IN OR TURN THE GAS CONTROL KNOB . NEVER USE TOOLS. IF THE KNOB WILL NOT PUSH IN OR TURN BY HAND, DON'T TRY TO REPAIR IT. CALL A QUALIFIED SERVICE TECHNICIAN. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.

D. DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE APPLIANCE AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.

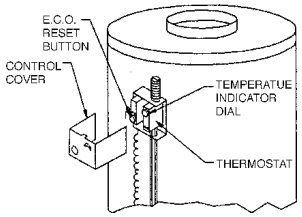
E. DO NOT OPERATE APPLIANCE UNLESS UNIT IS FILLED WITH WATER AND INLET LINES AFTER FULLY OPEN.



OPERATING

1. STOP! READ THE SAFETY INFORMATION ON THIS LABEL.
2. TURN "OFF " ALL ELECTRICAL POWER TO THE APPLIANCE. THE FLUE DAMPER WILL AUTOMATICALLY SPRING TO "OPEN" POSITION
3. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE PILOT. DO NOT TRY TO LIGHT THE PILOT BY HAND.
4. REFER TO THE DIAGRAMS ABOVE. TURN TOP KNOB OF THE GAS CONTROL VALVE CLOCKWISE TO "OFF" POSITION (FIG. A).
5. REMOVE THERMOSTAT CONTROL COVER. ROTATE THERMOSTAT DIAL-BY HAND-COUNTERCLOCK-WISE TO LOWEST SETTING. DO NOT FORCE DIAL OR MECHANICAL STOP.
6. WAIT FIVE (5) MINUTES TO CLEAR OUT ANY GAS . IF YOU THEN SMELL GAS:

   STOP! FOLLOW "B" IN THE SAFETY INFORMATION ABOVE IN THIS LABEL. IF YOU DON'T SMELL GAS. GO TO NEXT STEP.



7. TURN GAS CONTROL TOP KNOB COUNTERCLOCKWISE TO "ON" POSITION, DO NOT FORCE KNOB.
8. TURN ON ALL ELECTRICAL POWER TO THE APPLIANCE.
9. ROTATE APPLIANCE THERMOSTAT DIAL BY HAND DESIRED SETTING. DO NOT FORCE. FLUE DAMPER WILL "OPEN" AND PILOT IGNITION WILL OCCUR. WHEN PILOT IGNITION IS SENSED, THE MAIN BURNER(S) WILL IGNITE.
10. REPLACE THERMOSTAT CONTROL COVER.
11. IF THE APPLIANCE WILL NOT OPERATE. FOLLOW THE INSTRUCTIONS "TO TURN OFF GAS TO APPLIANCE" AND CALL YOUR SERVICE TECHNICIAN OR GAS SUPPLIER.

TO TURN OFF GAS TO APPLIANCE

1. ROTATE THERMOSTAT DIAL -BY HAND- COUNTERCLOCKWISE TO LOWEST SETTING. SEE STEP 5 ABOVE.
2. TURN OFF ALL ELECTRICAL POWER TO THE APPLIANCE IF SERVICE IS TO BE PERFORMED.
3. REMOVE CONTROL ACCESS PANEL.
4. TURN KNOB OF GAS CONTROL VALVE CLOCKWISE TO "OFF" POSITION. SEE STEP 4 ABOVE AND DIAGRAMS.
5. REPLACE CONTROL ACCESS COVERS (SEE STEP 10 ABOVE).

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

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B. BEFORE OPERATING SMELL ALL AROUND THE APPLIANCE AREA FOR GAS . BE SURE TO SMELL NEXT TO THE FLOOR BECAUSE SOME GAS IS HEAVIER THAN AIR AND WILL SETTLE ON THE FLOOR.

WHAT TO DO IF YOU SMELL GAS

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D. DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE APPLIANCE AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.

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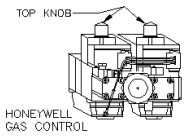

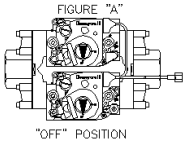

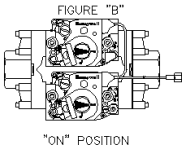

OPERATING

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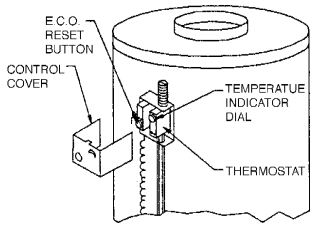
2. TURN "OFF " ALL ELECTRICAL POWER TO THE APPLIANCE. THE FLUE DAMPER WILL AUTOMATICALLY SPRING TO "OPEN" POSITION
3. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE PILOT. DO NOT TRY TO LIGHT THE PILOT BY HAND.
4. REFER TO THE DIAGRAMS ABOVE. TURN TOP KNOB OF THE GAS CONTROL VALVE CLOCKWISE TO "OFF" POSITION (FIG. A).
5. REMOVE THERMOSTAT CONTROL COVER. ROTATE THERMOSTAT DIAL-BY HAND-COUNTERCLOCK-WISE TO LOWEST SETTING. DO NOT FORCE DIAL OR MECANICAL STOP.
6. WAIT FIVE (5) MINUTES TO CLEAR OUT ANY GAS . IF YOU THEN SMELL GAS:

   STOP! FOLLOW "B" IN THE SAFETY INFORMATION ABOVE IN THIS LABEL. IF YOU DON'T SMELL GAS. GO TO NEXT STEP.



7. TURN GAS CONTROL TOP KNOB COUNTERCLOCKWISE TO "ON" POSITION, DO NOT FORCE KNOB.
8. TURN ON ALL ELECTRICAL POWER TO THE APPLIANCE.
9. ROTATE APPLIANCE THERMOSTAT DIAL BY HAND DESIRED SETTING. DO NOT FORCE. FLUE DAMPER WILL "OPEN" AND PILOT IGNITION WILL OCCUR. WHEN PILOT IGNITION IS SENSED, THE MAIN BURNER(S) WILL IGNITE.
10. REPLACE THERMOSTAT CONTROL COVER.
11. IF THE APPLIANCE WILL NOT OPERATE. FOLLOW THE INSTRUCTIONS "TO TURN OFF GAS TO APPLIANCE" AND CALL YOUR SERVICE TECHNICIAN OR GAS SUPPLIER.

TO TURN OFF GAS TO APPLIANCE

1. ROTATE THERMOSTAT DIAL -BY HAND- COUNTERCLOCKWISE TO LOWEST SETTING. SEE STEP 5 ABOVE.
2. TURN OFF ALL ELECTRICAL POWER TO THE APPLIANCE IF SERVICE IS TO BE PERFORMED.
3. REMOVE CONTROL ACCESS PANEL.
4. TURN KNOB OF GAS CONTROL VALVE CLOCKWISE TO "OFF" POSITION. SEE STEP 4 ABOVE AND DIAGRAMS.
5. REPLACE CONTROL ACCESS COVERS (SEE STEP 10 ABOVE).

NOTE: When damper motor is energized, a small delay due to drive mechanism backlash occurs before a visual position change to the damper blade or shaft is noted. DO NOT FORCE, IMPEDE OR OTHERWISE ALTER OR BEND THE DRAFT HOOD ASSEMBLY OR DAMPER DRIVE MECHANISM OR MOTOR.

— During the motor operation the mechanically operated switch S_1 changes operating position and returns to the position noted in fig. 18.

— The "OPENING" of the R_3 contacts acts to de-energize the ignition module circuit and shut off main burner and pilot gases.

— Main burner and pilot burner remain "off" until next "call for heat". Appliance is in "standby" mode.

— Flue damper remains in "closed" position until next "call for heat".

— In the event of power failure or power interruption (servicing) the flue damper spring will function to "open" the damper. The damper will remain in the "open" position until power is restored.

If Power Restored/No Call For Heat:

— The flue damper motor will again operate to "close" the damper. The appliance will remain in the "standby" mode.

If Power Restored/Call For Heat:

— The damper mechanism is already in the position noted in fig. 19. The damper remains "opened" and the appliance ignition system is immediately energized.

WATER TEMPERATURE CONTROL

DANGER

THIS WATER HEATER IS EQUIPPED WITH AN ADJUSTABLE THERMOSTAT TO CONTROL WATER TEMPERATURE. HOT WATER TEMPERATURES REQUIRED FOR AUTOMATIC DISHWASHER AND LAUNDRY USE CAN CAUSE SCALD BURNS RESULTING IN SERIOUS PERSONAL INJURY AND/OR DEATH. THE TEMPERATURE AT WHICH INJURY OCCURS VARIES WITH THE PERSON'S AGE AND TIME OF EXPOSURE. THE SLOWER RESPONSE TIME OF DISABLED PERSONS INCREASES THE HAZARDS TO THEM. NEVER ALLOW SMALL CHILDREN TO USE A HOT WATER TAP, OR TO DRAW THEIR OWN BATH WATER. NEVER LEAVE A CHILD OR DISABLED PERSON UNATTENDED IN A BATHTUB OR SHOWER.

THE WATER HEATER SHOULD BE LOCATED IN AN AREA WHERE THE GENERAL PUBLIC DOES NOT HAVE ACCESS TO SET TEMPERATURES.

SETTING THE WATER HEATER TEMPERATURE AT 120°F WILL REDUCE THE RISK OF SCALDS. Some states or provinces require settings at specific lower temperatures.

Below you will find listed the approximate time-to-burn relationship for normal adult skin. Short repeated heating cycles caused by small hot water uses can cause temperatures at the point of use to exceed the thermostat setting by up to 20°F (11°C). If you experience this type of use, you should consider using lower temperature settings to reduce scald hazards.

Temperature Setting	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
180°F (82°C)	Nearly instantaneous
170°F (77°C)	Nearly instantaneous
160°F (71°C)	About 1/2 second
150°F (65°C)	About 1-1/2 seconds
140°F (60°C)	Less than 5 seconds
130°F (54°C)	About 30 seconds
120°F (49°C)	More than 5 minutes

Valves for reducing point-of-use temperature by mixing cold and hot water are available. Also available are inexpensive devices that attach to faucets to limit hot water temperatures. Contact a licensed plumber or the local plumbing authority.

The water temperature is controlled by a thermostat, fig. 2, which has two sensing elements. One sensor is located near the top of the tank and the other is near the center. The thermostat is set in the lowest position before the heater leaves the factory.

The thermostat temperature dial, fig. 2, is accessible by removing the control cover. The dial is adjustable and may be set for 120^0 (49°C) to 180^{0}F (82°C) water temperature, but 120^{0}F (49°C) is the recommended starting point. It is suggested the dial be placed on the lowest setting which produces an acceptable hot water supply. This will always give the most energy efficient operation. The temperature control has a 4^{0}F fixed differential.

PREVENTIVE MAINTENANCE

CHECK THE PILOT

At least once a year, check the pilot burner, fig. 20, and the main burner, fig. 21, for proper operation. Refer to the following pilot and main burner sections.

PILOT BURNER

For access to pilot, unfasten two screws to burner cover and remove. Locate the burner with pilot and remove screw holding burner to manifold. Unfasten pilot tubing from valve and slide out burner and pilot.

Servicing of the pilot burner includes keeping pilot free of lint, cleaning the burner head, the primary air opening and the orifice of the pilot burner.
Pilot burner flame is affected by:

1. Low gas pressure.
   - Adjust pilot flame by means of the pilot gas adjustment located on the gas valve. See fig. 22.

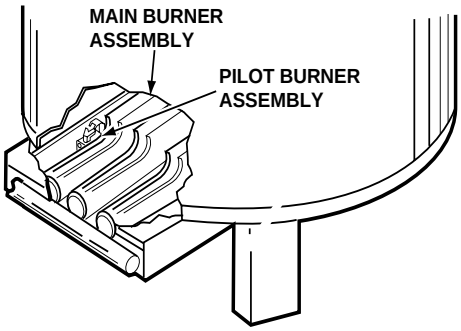


FIGURE 19

- The pilot flame should envelop sensing device with 5/8" (1.6cm) flame, fig. 21. Remove pilot adjustment cover screw, fig. 22. Turn inner adjustment screw clockwise to decrease, or counterclockwise to increase pilot flame. Be sure to replace cover screw on gas valve after adjustment to prevent possible gas leakage.

2. Clogged pilot burner orifice.

   • Clean or replace orifice. A clogged orifice will restrict gas flow.

3. Incorrect orifice.

   • Replace. See Table Vll, for correct orifice for type of gas used. Orifice size is stamped on the wrench flats.

Pilot sensing device must sense a flame before sparking will stop. Loose wires or a draft may cause intermittent or abnormal sparking. To eliminate this condition, first correct loose wiring condition, and then, if necessary, increase pilot flame.

PILOT BURNER ASSEMBLY

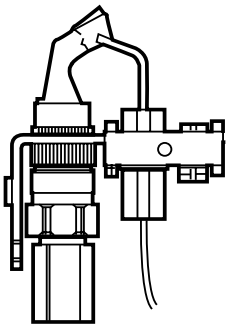


FIGURE 20

MAIN BURNER

The main burner, fig. 21, should display the following characteristics:

- Cause rapid ignition and carry over of flame across entire burner.
- Give reasonably quiet operation during ignition, burning and extinction.

- Cause no excessive lifting of flame from burner ports.

TYPICAL PILOT AND MAIN BURNER FLAMES

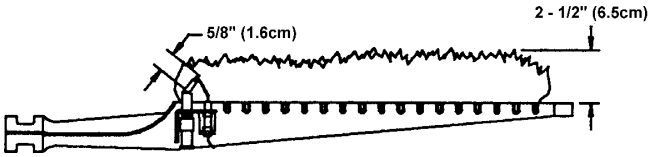


FIGURE 21

If the preceding burner characteristics are not evident, check for accumulation of lint or other foreign material that restricts or blocks the air openings to the burner or heater.

NOTE: Cleaning of main burners.

1. Remove main burners from unit.

2. Check that burner venturi and ports are free of foreign matter.

3. Clean burners with bristle brush and/or vacuum cleaner — DO NOT distort burner ports or pilot location.

4. Reinstall burners in unit. Make sure front and rear of burners are installed correctly in burner support brackets.

Also check for good flow of combustion and ventilating air to the unit. Maintain a clear area around the heater at all times.

GAS VALVES

Figure 22 shows the type of combination manual gas control valve and regulator used on these heaters.

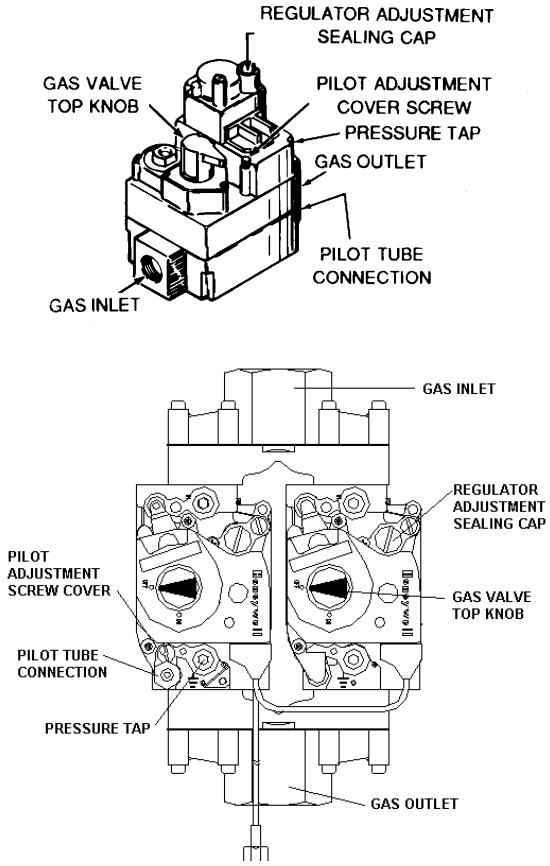


FIGURE 22

If the gas valve becomes defective, repairs should not be attempted. A new valve should be installed in place of the defective one.

CHECKING THE INPUT

For appliance installation locations with elevations above 2000 feet (610 m), refer to HIGH ALTITUDE INSTALLATIONS section of this manual for input reduction procedure.

1. Attach a pressure gauge or a manometer to the gauge port and refer to Table lV, for correct manifold pressure.

2. Use this formula to "clock" the meter. Be sure that other gas consuming appliances are not operating during this interval.

   $\frac{3600}{T} \times H = \text{Btuh}$

   T = Time in seconds to burn one cubic foot of gas.

   H = Btu's per cubic foot of gas.

   Btuh = Actual heater input.

   Example: (Using BTC-240 heater)
   T = 15.8 seconds

   H = 1050 Btu

   Btuh = ?

   $\frac{36.8}{15.9} \times 1050 = 240{,}000$ Btuh (70.3 Kwh) (Compare with heater model and rating)

Should it be necessary to adjust the gas pressure to the burners to obtain the full input rate, the steps below should be followed:

3. Remove the regulator adjustment sealing cap, fig. 17, and adjust the pressure by turning the adjusting screw with a screwdriver.

   Clockwise to increase gas pressure and input rate.

   Counterclockwise to decrease gas pressure and input rate.

4. "Clock" the meter as in step 2 above.

5. Repeat steps 3 and 4 until the specified input rate is achieved.

6. Turn the gas control knob to PILOT. Remove the pressure gauge and replace the sealing cap and the allen wrench set screw in the pressure tap opening.

WARNING

UNDER NO CIRCUMSTANCES SHOULD THE GAS INPUT EXCEED THE INPUT SHOWN ON THE HEATER MODEL AND RATING PLATE. OVERFIRING COULD RESULT IN DAMAGE OR SOOTING OF THE HEATER.

When the heater is operating at full capacity, or full gas input, it should consume 1 cu. ft. of gas in time indicated on Table V.

VENTING SYSTEM

Examine the venting system every six months for obstructions and/or deterioration of the vent piping.

Remove all soot or other obstructions from chimney which will retard free draft.

REMOTE STORAGE TANK TEMPERATURE CONTROL

The water temperature in the storage tank (if used) is controlled by the storage tank temperature control. The sensing element is mounted in the hot water storage tank, see page 17.

A change in water temperature in the storage tank lower than the tank temperature control setting will cause the sensor to activate the circulating pump. The pump then circulates the water through the heater where the thermostat senses the drop in water temperature and activates main burner operation of the appliance. If the storage tank temperature control is out of calibration, replace with new control.

WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS CONTROL VALVE TO THE APPLIANCE.

RELIEF VALVE

At least once a year, the temperature and pressure relief valve should be checked to ensure that it is in operating condition. Lift the lever at the top of the valve several times until the valve seats properly and operates freely.

If the appliance installation includes other relief valves, such as in "remote" storage tanks etc., check their relief valve operation with the same frequency.

WARNING

THE WATER PASSING OUT OF THE VALVE DURING THIS CHECKING OPERATION MAY BE EXTREMELY HOT. AVOID CONTACT AND DISCHARGE SAFELY TO PREVENT WATER DAMAGE.

If the temperature and pressure relief valve on the heater discharges periodically or continuously, a problem exists. This may be due to unusually high water temperatures or pressures in the system, or to a faulty relief valve. Contact your dealer or a qualified service technician to find the cause of the problem and to correct it. This may also be due to thermal expansion in a closed water supply system. Contact the water supplier or local plumbing inspector on how to correct this situation. DO NOT PLUG THE TEMPERATURE AND PRESSURE RELIEF VALVE.

WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS CONTROL VALVE TO THE APPLIANCE.

HOT WATER ODOR

On occasion, hot water may develop a strong odor. If this occurs drain the heater completely, flush thoroughly, and refill. If the problem persists, chlorination of the heater and replacement of the factory installed magnesium anodes with aluminum anodes may correct the condition.

Occasionally water softener companies recommend removal of heater anodes for odor reasons.

CAUTION

Unauthorized removal of the anode(s) will void the warranty. For further information contact your dealer.

ANODE ROD INSPECTION

The heater tank is equipped with anode rods to provide corrosion control. At least once a year the anode rods should be checked to determine if replacement is necessary. Initially the anode rods are approximately 7/8" (22mm) in diameter with a 1/8" (3mm) diameter steel core wire running down the center of the anode material. THE ANODES SHOULD BE REPLACED when the 1/8" (3mm) diameter core wire is visible as this means that the anode material has been expended in the control of corrosion.

For models with top inlet and outlet, it is recommended that, before removing the inner cover for cleaning, inspection or removal of inner parts, you obtain two new nipple collars, part no. 74060. The nipple collars on the heater will usually be damaged when removed. New pipe collars will insure that the seal is such as to prevent leakage of flue products when properly installed.

NOTE: **Anode rod inspection may need to be made more frequently in areas subject to acid rain that obtains their water supply from surface water as the low pH will accelerate anode activity.**

CAUTION: **Close cold water inlet valve serving heater and open nearby hot water faucet to relieve the pressure in the heater before attempting to remove anode(s) for inspection.**

RECOMMENDED PROCEDURE FOR PERIODIC REMOVAL OF LIME DEPOSITS FROM TANK TYPE COMMERCIAL WATER HEATERS

The amount of calcium carbonate (lime) released from water is in direct proportion to water temperature and usage, see chart. The higher the water temperature or water usage, the more lime deposits are dropped out of the water. This is the lime scale which forms in pipes, heaters and on cooking utensils.

Lime accumulation not only reduces the life of the equipment but also reduces efficiency of the heater and increases fuel consumption.

The usage of water softening equipment greatly reduces the hardness of the water. However, this equipment does not always remove all of the hardness (lime). For this reason it is recommended that a regular schedule for deliming be maintained.

The time between cleaning will vary from weeks to months depending upon water conditions and usage.

Refer to A. O. Smith booklet, Form No. 4800, entitled “Why? When and How” for detailed description on tank inspection and cleanout. UN•LIME® and the booklet may be obtained through your A. O. Smith dealer or distributor.

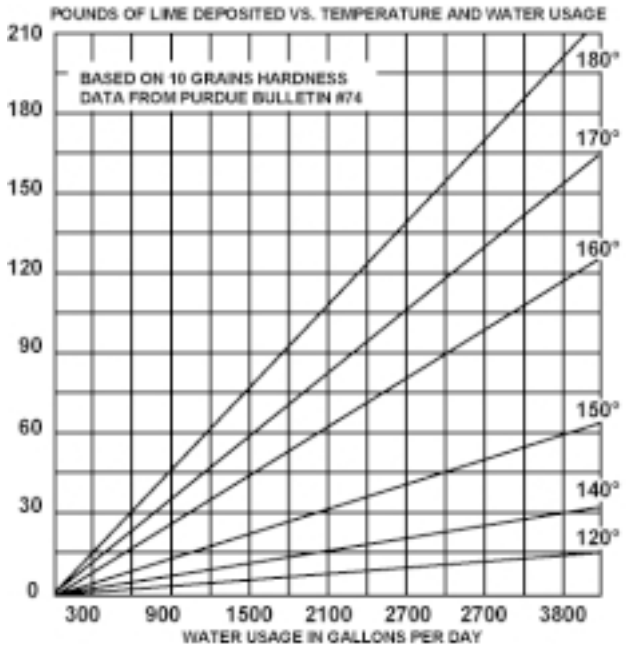


FIGURE 23

DELIMING SOLVENTS

A. O. Smith recommends the use of UN•LIME for deliming. UN•LIME is a patented food grade acid which is safe to handle and does not create the harmful fumes which are associated with other products.

UN•LIME may be obtained from your dealer, distributor or the A. O. Smith Product Service Division. Order Part Number 4763, 1 gallon (3.8 L), packed 4 gallons (15.2 L) per case or Part Number 4813, 5 gallon (18.9 L) container.

NOTE: Un•Lime is not available for use in Canada

Hydrochloric base acids are not recommended for use on glass lined tanks.

CAUTION

Observe handling instructions on label of product being used.

TANK CLEANOUT PROCEDURE

The following practices will ensure longer life and enable the unit to operate at its designed efficiency:

1. Once a month the heater should be flushed. Open the drain valve and allow two gallons of water to drain from the heater. Inlet water valve should remain open to maintain pressure in tank.

2. A cleanout opening is provided for periodic cleaning of the tank. Gas must be shut off and heater drained before opening cleanout.

To clean heater through cleanout opening, proceed as follows:

1. Disconnect electrical cover and drain heater.
2. Remove outer cover plate from lower side of heater jacket.
3. Remove six (6) hex head screws securing tank cleanout plate and remove plate.
4. Remove lime, scale, or sediment using care not to damage the glass lining.
5. Inspect cleanout plate gasket: if new gasket is required, replace with A. O. Smith Part No. 99038.
6. Install cleanout plate. Be sure to draw plate up tight by tightening screws securely.
7. Replace outer jacket cover plate.

In some water areas the sediment might not be removed by this method and may result in the water heater making rumbling or boiling noises. To dissolve and remove these more stubborn mineral deposits, A. O. Smith UN•LIME Professional Delimer should be used (except in Canada).

Flo-Jug Method of Deliming

The Flo-Jug is the standard 5 gallon (18.9 L) container for UN•LIME -or- it is available as a deliming kit with hose and fittings. Contact your dealer, distributor or the A. O. Smith Product Service Division.

Figure 24 illustrates most of the following steps.

1. The heater should be prepared for deliming as described in the "Why? When and How" booklet. The relief valve may also be delimed at this time.

2. With the Flo-Jug upright:

   • Take off cap, remove cover under opening and install 3/4" x 4" pipe nipple.
   • Drill or punch a 3/16" vent hole in handle. A stainless steel screw is included with the Flo-Jug kit. This screw is to be installed in the vent hole when Flo-Jug is not in use.
   • Remove drain valve from heater and insert a 3/4" x 4" nipple.
   • Connect and clamp 1" I.D. x 3' hose to Flo-Jug and heater nipple.

3. Lift the Flo-Jug to the pour position and permit the UN• LIME to flow into the heater as rapidly as possible.

   •Be sure to keep the vent just above the liquid level.

4. Place the Flo-Jug in the DELIME POSITION.

   • It may be necessary to place this empty jug on its carton to trap the solution in the heater.
   • Allow the UN•LIME to attack the water scale for 5 minutes.

5. Lower the Flo-Jug to the DRAIN POSITION and allow the UN•LIME to flow out of the heater as rapidly as possible.

   • Observe the vent hole and elevate the jug slightly if there is a possibility of spillage.
   • Deliming activity is indicated by foaming on the surface of the solution.

6. Continue the deliming process:

   • Raise jug to POUR POSITION. Allow solution to flow into heater.
   • Place jug in DELIME POSITION for 5 minutes. Solution is at work in heater.
   • Lower jug to DRAIN POSITION and allow solution to flow out. Observe foaming.

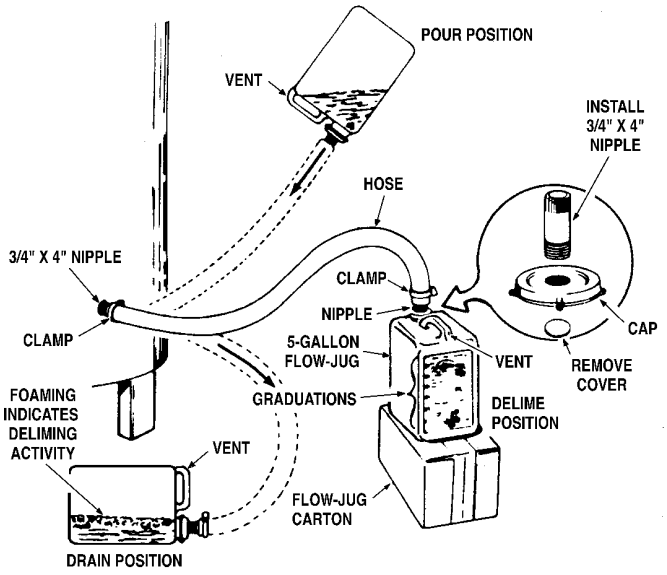


FIGURE 24

7. After one hour, or earlier if the deliming activity (foaming) stops, inspect the tank interior.

   • Drain the UN•LIME back into jug, DRAIN POSITION, and then stand jug in DELIME POSITION.
   • Remove clamp, hose and pipe nipple from heater drain opening.
   • Observe interior through opening - a small flashlight may be used effectively.
   • If the interior still shows water scale, the deliming process should be continued.
   • To check UN•LIME for continued use or reuse, place some lime scale or white chalk into a glass with a small amount of the solution. If the material is vigorously dissolved by the solution, the UN•LIME can be reused. If not, the UN•LIME has been weakened and should be replaced.

8. When deliming has been completed, the heater should be flushed for 3 to 5 minutes with fresh water.

   • Remove the deliming equipment, install the drain valve, open the cold water inlet line and allow water to flow through heater and out drain valve. Don't forget to plug vent and cap opening in Flo-Jug.

9. When flushing is completed:

   • Fill heater being certain to expel air from tank through a nearby hot water faucet or, if removed, the relief valve opening.
   • Replace relief valve if removed for deliming.
   • The heater relief valve can be washed in UN•LIME if it is limed.
   • Restore gas, oil or electrical supply to heater.
   • Check for water leakage.

10. Flo-Jug Cleanup:

   • Allow scale to separate from UN•LIME and settle on bottom of Flo-Jug.
   • Pour off UN•LIME into plastic container and check for reuse.
   • Rinse sediment from Flo-Jug.

TROUBLESHOOTING IGNITION MODULE SYSTEM

Before calling your service agent, the following checklist should be examined to eliminate obvious problems from those requiring replacement or servicing.

— Check that “main manual gas shutoff valve” is fully open and that gas service has not been interrupted.

— Check that after following the appliance OPERATING INSTRUCTIONS, the “Top Knob” of the appliance gas valve is in “ON” position.

— Check electrical supply to the appliance for possible blown (or tripped) fusing or power interruption.

— Is the water temperature in tank below the thermostat dial setting on the appliance thermostat (calling for heat)?

— It is possible that the high limit (E.C.O.) has functioned to shut off the appliance. See FEATURES — Water Temperature Control for reset procedure. Contact your serviceman if limit continues to function to shut off appliance.

TROUBLESHOOTING FLUE DAMPER DRIVE UNIT

FLUE DAMPER DRIVE UNIT NOT HAVING NORMAL/ SERVICE SWITCH

STEP 1: INSPECT DAMPER - Lower the thermostat so the unit will not be calling for heat; then inspect the damper.

- If the damper is open, go to step 2.
- If the damper is closed, go to step 3.

STEP 2: CHECK THE DAMPER DRIVE PC BOARD - Check for 24 VAC between the black PC board wire and the white PC board wire.

- If 24 VAC is not present, check the black wire connections between the PC board and the high limit.
- If 24 VAC is present, go to step 3.

STEP 3: TESTING THE PC BOARD AND THE MOTOR - Check for 24 VAC between the two motor lead connection terminals of the PC board. The motor leads can be disconnected from the terminals for this test.

- If 24 VAC is not present, replace the circuit board assembly.
- If the 24 VAC is present, this verifies the motor is receiving voltage but not running; replace motor.

FLUE DAMPER DRIVE HAVING A NORMAL/SERVICE SWITCH

STEP 1: WITH THE SWITCH IN NORMAL POSITION SET THE THERMOSTAT TO CALL FOR HOT WATER - Check for 24 VAC between the PC board white and black wires.

- If 24 VAC is not present, check the wiring between the black wire and ECO.
- If 24 VAC is present, go to Step 2.

STEP 2: WITH THE SWITCH IN NORMAL POSITION SET THE THERMOSTAT TO CALL FOR HOT WATER - Check for 24 VAC between the PC board yellow and white wires.

- If 24 VAC is present, go to Step 3.
- If 24 VAC is not present then check between yellow wire and thermostat.

STEP 3: WITH THE SWITCH IN NORMAL POSITION SET THE THERMOSTAT TO CALL FOR HOT WATER - Check for 24 VAC between the PC board red and white wires.

- If 24 VAC is present then problem is not with damper drive; check ignition module and gas valves.
- If 24 VAC is not present then go to Step 4.

STEP 4: WITH THE THERMOSTAT CALLING FOR HOT WATER, PLACE THE SWITCH IN THE SERVICE POSITION AND VERIFY THE DAMPER DISC IS VERTICAL - Check for 24 VAC between the PC board red and white wires.

- If 24 VAC is present then problem is not with damper drive; check ignition module and gas valves.
- If 24 VAC is not present then replace damper drive PC board.

SERVICE

The installer may be able to observe and correct certain problems which may arise when the unit is put into operation. HOWEVER, it is recommended that only qualified servicemen, using appropriate test equipment, be allowed to service the heater.

As preliminary step, check wiring against diagram, check for grounded, broken or loose wires. Check all wire ends to be sure that they are making good contact.

ELECTRICAL SERVICING

CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION.

VERIFY PROPER OPERATION AFTER SERVICING.

REPLACEMENT PARTS

Replacement parts may be ordered through A.O. Smith dealers, authorized servicers or distributors. Refer to the Yellow Pages for where to call or contact the A.O. Smith Water Products Company, Product Service Division, 5621 West 115th Street, Alsip, IL 60803, 1-800- 433-2545. For Canada contact: A.O. Smith Enterprises Ltd., P.O. Box 310, 768 Erie Street, Stratford, Ontario, Canada N5A 6T3, 519-271-5800. When ordering parts be sure to state the quantity, part number and description of the item(s) including the complete model and serial number as it appears on the product. Refer to the parts list for more information.

OPERATIONAL CHECKLIST

This checklist in conjunction with “TROUBLESHOOTING” and the “SEQUENCE OF OPERATION” should be used as an on-the-job troubleshooting guide to identify the cause of incorrect system operation and suggest a remedy for its correction. Because improper piping and wiring can result in unsatisfactory system performance, it is suggested that the installation by examined before using the checklist. Be sure to refer to the correct piping and wiring diagram for the type of system that is installed.

The system should be filled with water, purged of air, valves properly set and utilities connected and ready to operate.

COMPLAINT	CAUSE	REMEDY	
		USER	SERVICE MAN
*Water not hot enough.	Thermostat set too low.	Set thermostat dial to a higher temperature.	
	Thermostat out of calibration.	Call serviceman.	Recalibrate thermostat. If thermostat cannot be recalibrated replace.
*Insufficient hot water *See **WATER TEMPERATURE CONTROL WARNING** (on page 5).	Thermostat set to low.	Set thermostat dial toa higher temperature.	
	Termostat out of calibration.	Call serviceman.	Recalibrate thermostat. If thermostat cannot be recalibrated, repalce.
	Main manual gas shutoff valve partially closed.	Open main manual gas shutoff valve to fullest extent.	
	Heater too small for demand.	Space usage to give heater time to restore water temperature.	
	Thermostat differential is too wide.	Call serviceman.	Replace dual bulb controller if differnential is greater than 4°F.
	Heater recovery is slower.	Call serviceman.	Check gas input. If incorrect, adjust gas pressure or repalce main burner orifice.
	Draft hood not installed or one or more flue baffles.	Call serviceman.	Install draft ood or baffles as furnished with unit.
Water temperature too hot.	Thermostat set too high.	Set thermostat to a lower setting.	
Heater makes sounds: sizzling.	Condensation on outside of tank- normal.		
Rumbling.	Sediment accumulation on bottom of tank.	Drain a quantity of water through drain valve. If rumbling persists, call a serviceman.	Delime heater.
Ticking or metallic sounds.	Expansion and contraction - normal.		
Pounding.	Air chambers in piping have become waterlogged.	Drain piping system and refill. Heater must be off while this is being done.	
Combustion Noises.	Too much primary air.	Adjust shutter.	
	Overfired heater. Incorrect burners or orifice for types of gas used.	Call serviceman.	Check and correct as nessessary.
Water leaks.	Drain valve not closed tightly.	If drain valve cannot be closed tightly, replace.	
	If leakage source cannot be corrected or identified, call serviceman.	Shut off gas supply to heater and close cold water inlet valve to heater.	Repair or incase of suspected tank leakage, be certain to confirm before replacing heater.
Gas odors.	Heater is overfired.	Shut off gas supply to heater and call serviceman.	Check for sooted flue passage.
			Check for obstructed vent line.
			Check backdraft or lack of draft.
			Draft hood may be improperly installed or not sized properly.
	Possible gas leaks.	Shut off gas supply to heater and call gas company at once.	

Model BTR(C) Limited Warranty

A. O. Smith Corporation, the warrantor, extends the following LIMITED WARRANTY to the owner of this water heater.

1. **THE TANK**

If the glass-lined tank in this water heater shall prove upon examination by the warrantor to have leaked due to natural corrosion from potable water therein, during the first THREE years after initial installation, the warrantor will supply a complete new A. O. Smith water heater of equivalent size and current model. Some government agencies are requiring energy efficient standards for water heaters. In the event regulations prohibit sale of a model of equivalent size and construction, A. O. Smith will provide a model which complies with the regulations of your area, in which case the consumer will be charged the difference in price between the like replacement and the energy efficient model required. The warranty on the replacement water heater will be limited to the unexpired term of the original warranty.

2. **ALL OTHER PARTS**

If within ONE year after initial installation of this water heater, any part or portion shall prove upon examination by the warrantor to be defective in material or workmanship, the warrantor will repair or replace such part or portion at its option.

3. **CONDITIONS AND EXCEPTIONS**

This warranty shall apply only when the water heater is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices. In addition, a temperature and pressure relief valve, certified by A.G.A./CGA and approved by the American Society of Mechanical Engineers, must have been installed.

a. This warranty shall apply only when the heater is used:
   (1) at temperatures not exceeding the maximum setting of its thermostat;
   (2) at water pressure not exceeding the working pressure shown on the water heater;
   (3) when operated free from the damaging effects of uncontrolled water hammer;
   (4) when filled with potable water, free to circulate at all times;
   (5) in a noncorrosive and non-contaminated atmosphere;
   (6) with factory approved anode(s) installed;
   (7) in the United States, its territories or possessions, and Canada.
b. Any accident to the water heater, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form, any use of insulation blankets, or any attempt to repair tank leaks will void this warranty.
c. This warranty is void if a device acting as a backflow prevention device (check valves etc.) is installed in the cold water supply the heater is connected to, unless an effective method of controlling thermal expansion is also installed at the heater(s) and operational at all times. The relief valve installed on the heater is not an acceptable method.

4. **SERVICE AND REPAIR EXPENSES**

Under the limited warranty the warrantor will provide only a replacement water heater or part thereof. The owner is responsible for all other costs. Such costs may include but are not limited to:

a. Labor charges for service removal, repair or reinstallation of the water heater or any component part;
b. Shipping, delivery, handling, and administrative charges for forwarding the new heater or replacement part from the nearest distributor and returning the claimed defective heater or part to such distributor.
c. All cost necessary or incidental for any material and/or permits required for installation of the replacement heater or part.

5. **LIMITATIONS ON IMPLIED WARRANTIES**

Implied warranties, including the warranty of merchantability imposed on the sale of this heater under state or provincial law are limited to one (1) year duration for the heater or any of its parts. Some states and provinces do not allow limitation on how long an implied warranty lasts, so the above limitation may not apply to you.

6. **CLAIM PROCEDURE**

Any claim under the warranty should be initiated with the dealer who sold the heater, or with any other dealer handling the warrantor's products. If this is not practicable, the owner should contact:

U.S. Customers	Canadian Customers
A. O. Smith Water Products Company	A. O. Smith Enterprises Ltd.
5621 West 115th Street	P. O. Box, 310 - 768 Erie Street
Alsip, IL 60803	Stratford, Ontario N5A 6T3
Telephone: 1-800-323-2636	Telephone: (519) 271-5800

a. The warrantor will only honor replacement with identical or similar water heater or parts thereof which are manufactured or distributed by the warrantor.
b. Dealer replacements are made subject to in-warranty validation by warrantor.

7. **DISCLAIMERS**

NO OTHER EXPRESS WARRANTY HAS BEEN OR WILL BE MADE IN BEHALF OF THE WARRANTOR WITH RESPECT TO THE HEATER OR THE INSTALLATION, OPERATION, REPAIR OR REPLACEMENT OF THE HEATER. THE WARRANTOR SHALL NOT BE RESPONSIBLE FOR WATER DAMAGE, LOSS OF USE OF THE UNIT, INCONVENIENCE, LOSS OR DAMAGE TO PERSONAL PROPERTY OR OTHER CONSEQUENTIAL DAMAGE. THE WARRANTOR SHALL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR DAMAGE TO ANY PERSONS OR PROPERTY, WHETHER DIRECT OR INDIRECT, AND WHETHER ARISING IN CONTRACT OR IN TORT.

a. Some states or provinces do not allow the exclusion or limitation of the incidental or consequential damage, so the above limitations or exclusions may not apply to you.
b. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.

Fill in the following for your own reference. Keep it. Registration is not a condition of warranty. The model and serial number are found on the heater's rating plate.

Model No._____ Serial No._____Date Installed_____

Dealer's Name_____

Dealer's Address_____ Phone No._____

City and State/Province_____Zip/PostalCode_____

KEEP THIS WARRANTY POSTED ADJACENT TO THE HEATER FOR FUTURE REFERENCE